HITACHI

MODEL V-1150 OSCILLOSCOPE

SERVICE MANUAL

Hitachi Denshi, Ltd.

CONTENTS

1. SPECIFICATIONS

o CRT

Configuration and useful screen:	6-inch rectangular screen with internal graticule; 8 x 10 div (1 div = 1 cm), marking for measurement of rise time
Accelerating potential:	20 kV approx.
External intensity modulation:	Voltage: 5 Vp-p or more Bandwidth: DC to 3.5 MHz Maximum input voltage: 20V (DC + peak AC) Input impedance: 12 kΩ (typical)
Scale illumination:	Variable

o VERTICAL DEFLECTION

Sensitivity:	[CH1 and CH2] 2 mV /(div) to 5 V/div in 11 calibrated steps $\pm$2%, (2 mV/div $\pm$4%) at +10 to 35°C, Continuously variable control between steps at least 1:2.5 (with UNCAL displayed [CH3 and CH4] 0.1 V/div, 0.5 V/div $\pm$2% (at +10 to 35°C) in 2 calibrated steps
Bandwidth:	[CH1 and CH2] DC to 150 MHz, -3 dB (2 mV/div: DC to 20 MHz, -3 dB) [CH3 and CH4] DC to 150 MHz, -3 dB
Rise time:	2.3 ns (2 mV/div: 17.5 ns)
Delay time:	Permits viewing leading edge of displayed waveform.
Maximum input voltage:	400 V (DC + peak AC at 1 kHz)

Input coupling:	[CH1 and CH2]: AC-GND-DC, [CH3 and CH4]: AC-DC
Input impedance:	Direct: 1 MΩ, approx. 22 pF
Display modes:	CH1, CH2, CH3, and CH4 (Any combination is available.) ALT, CHOP (approx. 250 kHz), ADD (DIFF mode can be established when the CH2 is in the INV mode.)
Quad mode:	Permits positioning independently.
Bandwidth limitation:	20 MHz approx.
Polarity switching:	+ or - (CH2 only)
X-Y operation	CH1: X axis, CH2: Y axis
Sensitivity:	2 mV/div to 5 V/div
Phase error:	3° or less from DC to 1 MHz
X bandwidth:	DC to 2 MHz, -3 dB
Dynamic range:	8 div or more
Common-mode rejection ratio:	At least 20 dB at 20 MHz
Delay difference:	Between CH1 and CH2: 0.5 ns max. Others: 1 ns max.

o HORIZONTAL DEFLECTION

Trigger mode:	Trigger, Automatic trigger, Single sweep
Auto level:	Possible
Trigger source:	A: CH1, CH2, CH3, CH4, ALT (CH1 and CH2), LINE B: CH1, CH2, CH3, CH4
Trigger coupling:	A: AC, DC, HF-REJ, LF-REJ, TV-V, TV-H B: AC, DC, TV-H
TV trigger	Sync pulse more than 1 div

Trigger sensitivity:

	DC to 30 MHz	30 to 150 MHz
CH1 and CH2	0.3 div	1.5 div
CH3 and CH4	0.5 div	1.5 div

Trigger variable range: ±8 div approx.

AUTO low bandwidth: Approx. 30 Hz

Trigger slope: A: + or −, B: + or −

Time base

A (Main) sweep: 20 ns/div to 0.5 s/div ±2% in 23 calibrated steps, 1-2-5 sequence (at 10 to 35°C), Uncalibrated continuous control between steps at least 1:2.5

B (Delay) sweep: 20 ns/div to 50 ms/div ±2% in 20 calibrated steps, 1-2-5 sequence (at 10 to 35°C)

A trigger variable holdoff: Adjustable control permits a stable triggering of repetitive complex waveform

Display modes: A only, alternate, A intensitied by B, B delayed

Delay time: 1 μs to 5 s

Delay time jitter: Better than 1: 20,000

Sweep magnification: 10 times (±4%)

Maximum sweep rate: 2 ns/div

o READOUT FUNCTION

Panel setting displays:

Vertical axis:	V/div (CH1 and CH2 only), INVERT, ADD, BW LIMIT 20 MHz, UNCAL, Input coupling
Horizontal axis:	s/div, UNCAL, MAG (converted value)
Others:	Delay time, Trigger source

Digital measurement:

DVM (CH2 only)	DC voltage: Corresponds to the screen.
	AC voltage: 50 Hz to 10 MHz (Conversion method: Average measurement), dB display is available.

Frequency counter:	Interlocking operation with the trigger signal Frequency: 10 Hz to 150 MHz

AC volt meter specifications: (CH2 only)

VOLTS/DIV switch	Full scale	Resolution	Accuracy (X1 probe)
2mV/div		0.02mV	Not specified.
5mV/div		0 05mV	Frequency: 1kHz to 1MHz ±(2% of reading + 1.8% of full scale)
10mV/div		0.1mV	
20mV/div	V/div x 2.8284 (≦ 8 div)	0.2mV	
50mV/div		0.5mV	
0.1V/div		1mV	Frequency: 50Hz to 5MHz ±(5% of reading + 1.8% of full scale)
0.2V/div		2mV	
0.5V/div		5mV	
1V/div		0.01V	Frequency: 5 to 10 MHz ±(10% of reading + 1.8% of full scale)
2V/div		0.02V	
5V/div		0.05V	

* Over 2 divisions signals are recommended for AC V measurement.

** Additional error ±1.5% when using X10 probe.

DC volt meter specifications: (CH2 only)

VOLTS/DIV switch	Full scale	Resolution	Accuracy (X1 probe)
2 to 50mV/div	±499.7mV	1/2000 of full scale	±(1% of reading + 0.25% of full scale)
0.1 to 0.5V/div	±4.997V		±(2% of reading + 0.25% of full scale)
1 to 5V/div	±49.97V		

* Set the DC-GND-AC switches to DC.

** Additional error ±1.5% when using X10 probe.

*** Although resolution range is 1/2000 (2.5) of the full scale (5000), the least significant digit is displayed in steps of 0, 2, 5, and 7.

Frequency counter specifications:

Frequency measurement:

Source	:	A trigger signal (CH1, CH2, CH3, and CH4)
Measuring range:		10 Hz to 150 MHz
Time base error:		±50 ppm (15 to 35°C)

Ranges	Display format (Max. frequency)	Resolution	Accuracy
10Hz ≦ f < 100Hz	99.990Hz	0.01Hz	±(|time base error| + resolution)
100Hz ≦ f < 1kHz	999.90Hz	0.1Hz	
1kHz ≦ f < 10kHz	9.9990kHz	1Hz	
10kHz ≦ f < 100kHz	99.999kHz	1Hz	
100kHz ≦ f < 1MHz	999.99kHz	10Hz	
1MHz ≦ f < 10MHz	9.9999MHz	100Hz	
10MHz ≦ f < 150MHz	149.999MHz	1kHz	
150MHz < f	Over range		

Period measurement: Source : A trigger signal (CH1, CH2, CH3, and CH4 only)

Measuring range: 6.7 ns to 100 ms

Time base error: ±50 ppm (15 to 35°C)

Ranges	Display format	Resolution	Accuracy
10ms ≦ T < 100ms	99.999ms	1μs	±(|time base error| + resolution)
1ms ≦ T < 10ms	9.9999ms	100ns	
0.1ms ≦ T < 1ms	0.99999ms	10ns	
10μs ≦ T < 100μs	99.999μs	1ns	
1μs ≦ T < 10μs	9.9990μs	1ns	
0.1μs ≦ T < 1μs	0.99990μs	100ps	
6.7ns ≦ T < 100ns	99.990ns	10ps	
≦ T < 6.7μs	Over range		

Event counter

1) EVENT IN DELAY TIME

Source: A trigger signal or B trigger signal (CH1, CH2, CH3, and CH4)

Maximum number of count: 2^{19-1}

Accuracy: A value of reading ±1 count

Maximum frequency: 20 MHz

2) EVENT IN B TIME

Source: A trigger signal or B trigger signal (CH1, CH2, CH3, and CH4)

Maximum number of count: 2^{19-1}

Accuracy: A value of reading ±1 count

Maximum frequency: 20 MHz

Cursor readout functions:

Cursors: REF, Δ

Voltage to the ground:	V	: Δ-GND
Voltage deviation:	ΔV	: Δ-REF
Amplitude ratio:	ΔV%	: %
	ΔV dB	: dB
		$\frac{\Delta - REF}{2 \text{ to } 8 \text{ div}} \times 100\%$
Time difference:	T	: Δ-REF
Time ratio:	T%	: %
		$\frac{\Delta - REF}{2 \text{ to } 8 \text{ div}} \times 100\%$
Frequency:	1/T	: Δ-REF
Phase:	PHASE	: ^{o} (degree)
		$\frac{\Delta - REF}{2 \text{ to } 8 \text{ div}} \times 360^{o}$

GND REF function: Displays GND reference cursors of CH1 and CH2.

Comment display function:

- Number of line: 2 lines
- Number of characters: 30 characters max.
- Range of characters:
  - Figures: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
  - Letters: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
  - Symbols and others: [ ] (space), . (period), :, -, ↑, ↓, ←, →, /, +, <, >, m, n, μ, k, s, z, %, Δ (delta), d, i, v, ° (degree), *
  - Available lines for comment display: Any two lines among six lines excluding the top and bottom lines

o OUTPUT SIGNALS

CH2 output

Output voltage:	Approx. 25 mV/div (corresponding to the full scale on the CRT screen) terminated into 50 Ω
Frequency response:	DC to 100 MHz
Output impedance:	Approx. 50 Ω
Gate signal output:	TTL positive gate pulse from A and B

o CALIBRATOR

Waveform:	1 kHz ±0.1% square wave
Voltage:	0.5 V ±1%

o POWER SUPPLY

Voltage:	90 to 250 V AC (not selectable)
Frequency:	48 to 440 Hz
Power consumption:	Approx. 75 W

o OUTER DIMENSIONS:	Approx. 330(13 in)(W) x 160(6.3 in)(H) x 410(16.2 in)(D) mm
o WEIGHT:	Approx. 10(22 lb) kg
o ENVIRONMENT	
Temperature:	Operating: -10 to +50°C Specification: +10 to +35°C Storage: -20 to +70°C
Humidity:	Operating: 35 to 85%

2. ACCESSORIES

The V-1150 Oscilloscope is shipped with the following standard accessories:

2	Probes (AT-10AN1.5)
1	AC Power Cord
1	Operation Manual
1	Fuse (2A)
1	Dust Proof Cover

3. PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the oscilloscope. The severity of environment to which this instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Disassembly

"WARNING
DANGEROUS VOLTAGES ARE EXPOSED WHEN THE COVER IS REMOVED. MAINTENANCE SHOULD BE CARRIED OUT ONLY BY QUALIFIED PERSONNEL."

Remove the top cover and the bottom cover of the instrument.
Most of the internal parts of the instrument are now accessible.
If access to the front of the circuit boards are necessary, remove the knobs from the external control shafts on the board.

Cleaning

The instrument should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause component breakdown.
The covers provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush.
Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used. Cleaning the interior should only be occasionally necessary. The best way to clean the interior is to blow off the dust with a dry, low-velocity stream of air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate components.

Visual Inspection

The instrument should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is apparent; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, correcting the cause of the overheating is important to prevent recurrance of the damage.

4. CALIBRATION

Hitachi Denshi, Ltd. provides complete instrument repair and recalibration at our oversea's office, and authorized dealer. Contact your local Hitachi Denshi, Ltd. office or representative.

4.1 Calibration interval

To maintain instrument accuracy, perform the calibration of the V-1150 at least every 1000 hours of operations or every six month if used infrequently.

4.2 Test equipment required

The test equipment and accessories, or equivalent listed in Table 4-1, are required for the complete calibration of the V-1150. The given specifications for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications.
All the test equipment is assumed to be correctly calibrated and operating within the listed specification. Operating instructions for the test equipment are not given in this procedure. Refer to hte instruction manual for the test equipment if more information is needed.

4.3 Preliminary procedure

This instrument should be calibrated at an ambient temperature of +20°C ($\pm$5°C) for the best overall accuracy.

1. Connect the instrument to AC line voltage, 48 Hz to 440 Hz line source.
2. Set the instrument controls as given in the Preliminary Control Settings (page 16). Allow at least fifteen minutes of warmup before proceeding.
3. See the Adjustment Locations in the pullout pages.

Table 4-1
TEST EQUIPMENT REQUIRED

Description	Minimum Specification	Usage	Examples of Applicable Test Equipment
1. Constant Amplitude Signal Generator	50 kHz reference frequency; maximum frequency 200 MHz; variable amplitude	Check of horizontal, vertical and trigger bandwidth.	
2. Standard Amplitude Calibrator	Amplitude accuracy: 0.25%, variable amplitude; 5 mV to 40 V; frequency: 1 kHz square wave	Check of horizontal and vertical gain.	
3. Square-wave Generator	Variable frequency: 10 Hz to 1 MHz; output amplitude; 10 mV to 100 V	Check of probe and vertical compensation.	
4. Digital Multimeter	0.1% accuracy	Check of power supply.	
5. Digital Frequency Counter	0.1% accuracy	Check of CAL frequency.	
6. Time Mark Generator	0.1% accuracy	Check of sweep rate.	
7. Cable	Impedance, 50 Ω; type, RG-58/U; length, 42 inches, connectors, BNC.	Most check and adjustment with connecting signal.	Hitachi Part No. 4202
8. Termination	Impedance, 50 Ω; connectors, BNC.	Check of vertical amplifier compensation.	
9. Attenuator	Ratio, 10X; connectors, BNC; impedance, 50 Ω	Check of vertical amplifier bandwidth.	
10. T-Connector	Connectors, BNC.	Check of X-Y operation	Hitachi Part No. 1301
11. DC Power Source	0.1% accuracy	Check of DCV function	

4.4 Preliminary control settings

Preset the instrument controls to the setting given below, when starting the calibration procedures.

Controls		Setting	Controls	Setting
FOCUS		Midrange	VERT MODE	CH1
SCALE ILLUM		CCW	H.POSITION	Midrange
TRACE ROTATION		As desired	A TIME/DIV	1 ms/DIV
INTEN-SITY	A & B	Midrange	VAR HOLDOFF	CCW
	Δ B	CCW	Horizontal display mode	A
	READ OUT	CCW	TRIGGER LEVEL	Midrange
POSITION	CH1 CH2	Midrange Midrange	POSITION CH3 CH4	Midrange Midrange
V.VARIABLE		CW	A/B SWP SEP	Midrange
AC-GND-DC		GND	CURSOR, DLY/COUNTER	DLY/COUNTER

NOTE
CCW: Counterclockwise
CW : Clockwise

4.5 Initial starting procedure

1. Turn instrument POWER on.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up. A trace should appear on the display of the CRT.
3. If no trace appears, increase (clockwise) the INTENSITY A & B control setting until the trace is easily observed.
4. Adjust FOCUS control for the best focused display.
5. Readjust POSITION controls if necessary, to center the trace.

POWER SUPPLY SYSTEM

Refer to the ADJUSTMENT LOCATIONS in the pullout pages.

Control Settings

Preset the controls as given in the Preliminary Control Setting.

(1) Check Low-voltage Supply, if necessary.

a. Connect the digital voltmeter (DVM) from the +12 volt line.
: +11.975 V to +12.025 V (P1840-3)

b. Connect the DVM from the -12 V line.
: -11.75 V to -12.25 V (P1840-7)

c. Connect the DVM from the +5 V(d) line.
: +4.75 V to +5.25 V (P1840-4)

d. Connect the DVM from the +5 V(a) line.
: +4.75 V to +5.25 V (P1840-5)

e. Connect the DVM from the +45 V line.
: +44.90 V to +45.10 (P1840-2)

f. Connect the DVM from the 100 V line.
: +96 V to 104 V (P1840-1)

(2) Adjust Low-voltage Supply.

a. Adjust the adjustment RV1853 for DVM reading of +45 V (±0.10 V).

b. Adjust the adjustment RV1885 for DVM reading of +12 V (±0.025 V).

(3) Check High Voltage Supply.

a. Connect the DVM to the H.V. test point (PEF-738) by High Voltage Probe.

b. Check for a reading of -1805 V to -1995 V.

(4) Check/Adjust CRT Bias.

a. Set the horizontal display mode switch to the X-Y position, and AC-GND-DC switch to GND.

b. Rotate the INTENSITY A & B control, and set the voltage of TR1747-Collector to 15 V.

c. Observe the trace of CRT.

d. Adjust the Grid Bias Adjustment RV1779 so that the trace appears.

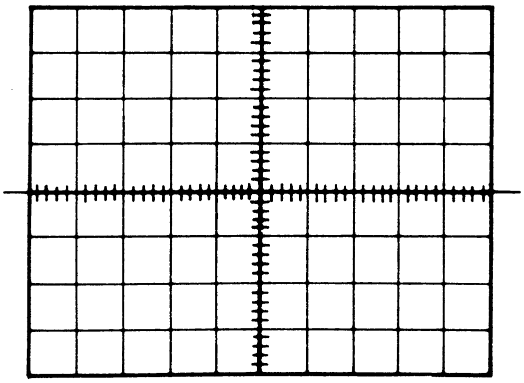
(5) Check/Adjust Trace Rotation

a. Set the A TIME/DIV switch to 1 ms/DIV, and the horizontal display mode switch to A.

b. Set a trace to the center of screen, using a position control.

c. Check that the trace is aligned with the center horizontal line.

d. Adjust TRACE ROTATION control on the front panel for a trace that is aligned with the horizontal graticule lines.



(6) Check/Adjust GEOMetry

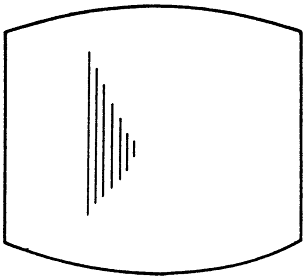
a. Set the A TIME/DIV switch to 0.1 ms/DIV, and AC-GND-DC to DC.

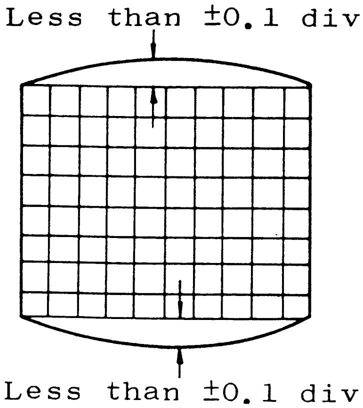
b. Connect a 1 MHz sinewave to the input.

c. Set the signal for a full-screen (8 divisions) deflection.

d. Check that horizontal bowing is less than ± 0.1 division.

e. Adjust the GEOM adjustment RV1730 for a display that is parallel with top and bottom horizontal lines.



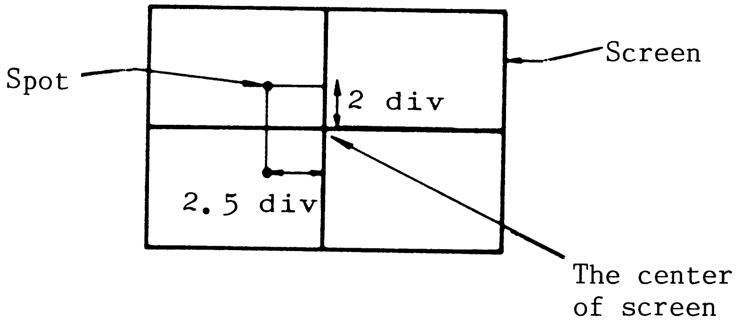


(7) Check/Adjust ASTIGmatism

a. Set:

Horizontal display mode	X-Y
AC-GND-DC	GND
INTENSITY READOUT	OFF
BW LIMIT 20 MHz	ON

b. Locate the spot as illustrated in the following figure, using CH1 and CH2 position controls.



c. Rotate the INTENSITY A & B control just before the spot has a halation.

d. Rotate FOCUS control fully clockwise.

e. Check that the spot is round.

f. Adjust the ASTIG adjustment RV1731 for a round spot.

g. Rotate FOCUS control to obtain a smallest spot, and push the BW LIMIT 20 Mhz switch off.

HORIZONTAL SYSTEM

Control Settings

Set the controls as given in the Preliminary Control settings on page 16.

(8) Check/Adjust Sweep Reference.

a. Turn the READOUT control on.

b. Set:

VERT MODE	CH1
CH1 AC-GND-DC	DC
Horizontal display mode	ALT
A TIME/DIV	1 ms/DIV
B TIME/DIV	10 μs/DIV

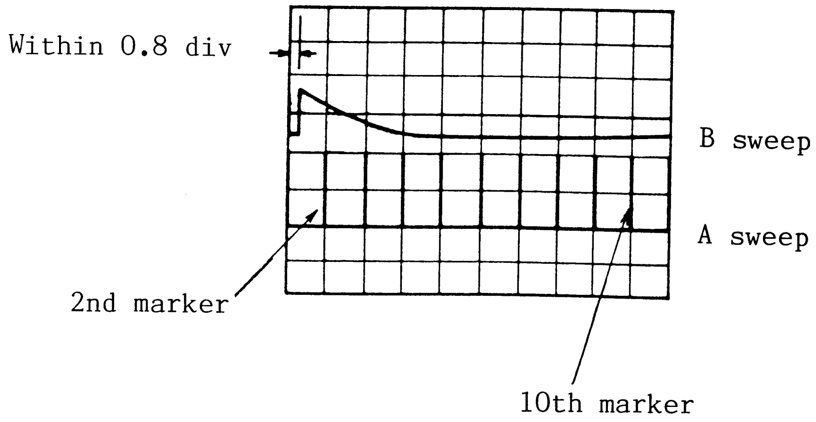
c. Set the CURSOR, DLY/COUNTER select switch to the DLY/COUNTER position (delay mode).

d. Connect the time mark generator to CH1 and set the time mark generator for 1 ms time marks.

e. Rotate the A/B SWP SEP control to position the B sweep trace for easy observation.

f. Turn the DLY POS control and set the delay time to 9.00 ms. Pressing turn is available for the fast operation.

g. Check the intensified portion of A sweep to align with the tenth time marker and the leading edge of the marker of B sweep to align with the left side graticule line, within 1.0 div.
(If the tenth time marker is off the screen, preadjust the H GAIN adjustment RV 1601, so that the tenth time marker will locate in the screen.)



h. Adjust RV 1326 for the leading edge of the marker of B sweep to align with the left side graticule line, within 0.8 div.

i. Set the delay time to 1.00 ms by turning the DLY POS control.

j. Check the intensified portion of A sweep to align with the second time marker and the leading edge of the marker of B sweep to align with the left side graticule line, within 1.2 div.

k. Adjust the DLY 1 DIV adjustment RV1251 for the leading edge of the marker of B sweep to align with the left side graticule line, within 0.8 div.

l. Repeat both RV1326 and RV1251 adjustment for no visible interaction.

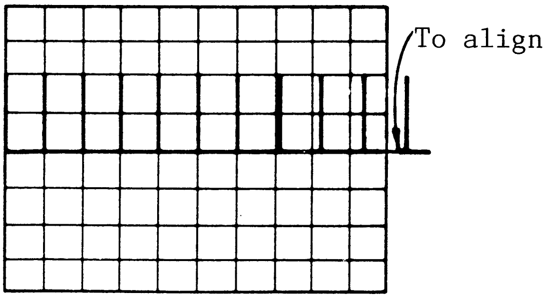
(9) Check/Adjust Horizontal Gain.

a. Set the horizontal display mode switch to A and A TIME/DIV switch to 1 ms/DIV.

b. Connect a 1 ms time mark generator.

c. Check that the time marks align with the ten divisions graticule lines, within 2 %

d. Adjust H GAIN adjustment RV1601 for the time marks to align with the graticule lines.



(10) Check/Adjust Horizontal x10 MAG Gain.

a. Set the horizontal display mode switch to A and the A TIME/DIV switch to 1 ms/DIV.

b. Connect a 1 ms time marker generator.

c. Set the x10 MAG switch to on.

d. Check the one-cycle time marks to align with the ten-divisions graticule lines, within 2%.

e. Adjust the MAG GAIN adjustment RV1608 fo one-cycle time marks to align with the ten-divisions graticule lines.

f. Set the x10 MAG switch to off after the check and adjustment.

(11) Check/Adjust MAG CENTer

a. Set the A TIME/DIV switch to the 1 ms/DIV.

b. Connect a 1 ms time marker generator.

c. Set the x10 MAG switch to on and align the second time marker with the center vertical graticule line.

d. Set the x10 MAG switch to off.

e. Check the discrepancy of the second time marker from the center vertical graticule line, within ±0.5 division.

f. Adjust the MAG CENT adjustment RV1602 for the discrepancy within ±0.2 division.

(12) Check/Adjust TIME/DIV

a. Set:

VERT MODE CH1
CH1 VOLTS/DIV .... As required
CH1 AC-GND-DC .... DC

b. Connect the time marker generator to CH1.

c. Set the TIME/DIV switches and the time marker generator as illustrated in the following table.

d. Check and adjust that the time marks align with the ten divisions graticule lines, within 2%.

Item No.	Display mode	A TIME/DIV	B TIME/DIV	Timer Marker	Adjustment
(1)	A	0.1 μs/DIV	-----	0.1 μs	CV1314
(2)	A	10 μs/DIV	-----	10 μs	RV1327
(3)	A	10 ms/DIV	-----	10 ms	RV1325
(4)	A	2 ns/DIV 20 ns/DIV, x10 MAG	-----	2 ns	CV1640
(5)	B	0.2 μs/DIV	0.1 μs/DIV	0.1 μs	CV1414
(6)	B	20 μs/DIV	10 μs/DIV	10 μs	RV1427
(7)	B	2 ms/DIV	1 ms/DIV	1 ms	RV1426
(8)	B	20 ms/DIV	10 ms/DIV	10 ms	RV1429

VERTICAL SYSTEM

Control Setting

Preset the controls as given in the Preliminary Control Settings.

(13) Check/Adjust DC BAL

a. Set the VERT MODE switch to CH1.

b. Set the CH1 VOLTS/DIV switch to 5 mV/DIV and the CH1 AC-GND-DC Switch to GND.

c. Position the trace to the center horizontal graticule line.

d. Change the CH1 VOLTS/DIV switch to the 10 mV/DIV.

e. Check that the discrepancy of the trace is within 0.3 division of the center horizontal graticule line.

f. Adjust the CH1 DC BAL1 adjustment RV28 for the discrepancy within 0.1 division of the center horizontal graticule line.

g. Set the CH1 VOLTS/DIV switch to 5 mV/DIV.

h. Position the trace to the center horizontal graticule line.

i. Set the CH1 VOLTS/DIV switch to 2 mV/DIV.

j. Check that the discrepancy of the trace is within 0.3 division of the center horizontal graticule line.

k. Adjust the CH1 DC BAL2 adjustment RV60 for the trace within 0.1 division of the center horizontal graticule line.

l. Change the VERT MODE switch to CH2.

m. Repeat b through e for CH2.

n. Adjust the CH2 DC BAL1 adjustment RV228 for the trace within 0.1 division of the center horizontal graticule line.

o. Repeat h through k for CH2.

p. Adjust the CH2 DC BAL2 adjustment RV160 for the trace within 0.1 division of the center horizontal graticule line.

(14) Check/Adjust POS CENT

a. Set the VERT MODE switch to CH1.

b. Set the POSITION control at the midrange.

c. Check that the trace is within 1 division of the center horizontal graticule line.

d. Adjust the CH1 POS CENT adjustment RV140 for the trace align with the horizontal center line.

e. Change the VERT MODE switch to CH2.

f. Repeat b through c for CH2.

g. Adjust the CH2 POS CENT adjustment RV340 for the trace at the horizontal center line.

h. Set the VERT MODE switch to CH3 and CH4.

i. Repeat b through c for CH3.

j. Adjust the CH3 POS CENT adjustment RV470 for a trace at the horizontal center line.

k. Repeat b through c for CH4.

l. Adjust the CH4 POS CENT adjustment RV570 for a trace at the horizontal center line.

(15) Check/Adjust ADD Balance

a. Set the VERT MODE switch to CH1 and CH2.

b. Position both CH1 and CH2 traces to coincide at the center horizontal graticule line.

c. Change the VERT MODE switch to ADD (press both the CH1 and CH2 buttons).

d. Check that the trace added to CH1 and CH2 is within ±0.4 division from the center horizontal graticule line.

e. Adjust RV711 for the trace within ±0.2 division from the center horizontal graticule line.

(16) Check/Adjust X1 DC GAIN

a. Set:

VERT MODE	CH1
CH1, CH2 VOLTS/DIV	10 mV/DIV
A TIME/DIV	1 ms/DIV
CH1, CH2 AC-GND-DC	DC

b. Connect the square-wave generator (using 1 kHz output range) to CH1.

c. Adjust the output amplitude of that generator for 5 divisions deflection of screen.

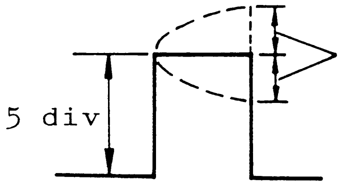
d. Check the high-voltage level of pulse is flat.

e. Adjust the CH1 x1 DC GAIN RV26 for a flat level.

f. Move the signal to CH2 and change the VERT MODE switch to CH2.

g. Repeat b through d for CH2.

h. Adjust the CH2 x1 DC GAIN adjustment RV226 for a flat level.



(17) Check/Adjust VERTICAL GAIN

a. Set the standard VERT MODE switch to the CH1 position.

b. Connect the standard amplitude calibrator to the CH1 input connector.

c. Set the CH1 VOLTS/DIV switch to the 10 mV and the CH1 AC-GND-DC switch to DC.

d. Set the standard amplitude calibrator for a 50 mVp-p signal.

e. Check for a 5 divisions display.

f. Adjust the V GAIN adjustment RV726 for a display for 5 divisions within 2%.

g. Change the VERT MODE switch to CH2, and move the signal to CH2.

h. Repeat b through e for CH2.

i. Adjust the CH2 GAIN adjustment RV290 for a display of 5 divisions within 2%.

j. Set the VERT MODE switch to the CH3 and CH4 position.

k. Move the signal to CH3.

l. Set the standard amplitude calibrator for a 0.5 Vp-p.

m. Set the CH3 0.1 V/DIV, 0.5 V/DIV switch to 0.1 V/DIV.

n. Check a 5 divisions display.

o. Adjust the CH3 GAIN adjustment RV433 so that a display of 5 divisions is within 2%.

p. Move the signal to CH4.

q. Set the CH4 0.1 V/DIV, 0.5 V/DIV switch to the 0.1 V/DIV.

r. Check a 5 divisions display.

s. Adjust the CH4 GAIN adjustment RV533 so that a display of 5 divisions is within 2%.

(18) Check/Adjust CH1, CH2 Step Response.

a. Set:

VERT MODE	CH1
CH1, CH2 VOLTS/DIV	10 mV/DIV
CH1, CH2 AC-GND-DC	DC
A TIME/DIV	20 ns

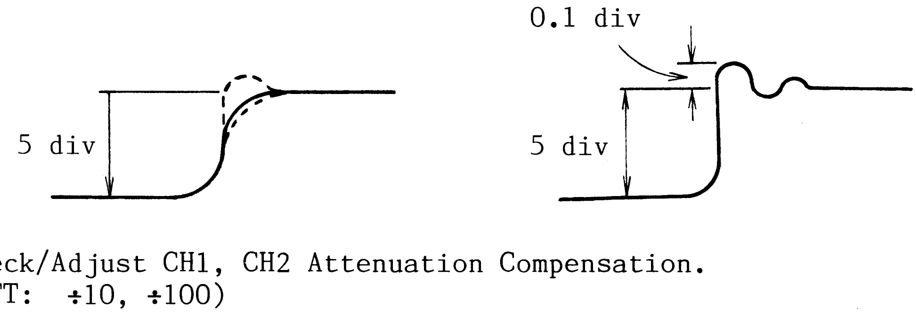
b. Connect the fast-rise (less than 1 ns), positive output of the square-wave generator to the CH1 input. Use a 50-ohm termination and cable.

c. Set the square-wave generator to 1 MHz. Adjust the square-wave generator output for a 5 divisions display.

d. Adjust CV708, CV731, CV732, RV709 and RV708 so that a flat square wave is obtained.

e. Move the signal to CH2 and set the VERT MODE to CH2.

f. Adjust CV280 and RV280 for over-shoot that is +0.1 div.



(19) Check/Adjust CH1, CH2 Attenuation Compensation.
(ATT: ÷10, ÷100)

a. Set the VERT MODE switch to CH1 and the CH1 and CH2 AC-GND-DC switch to DC.

b. Connect the square-wave (10 kHz) generator to the CH1 input terminal check for a square wave that is flat (flat top) under the following settings.

ATT	VOLTS/DIV	Square-wave generator output
÷ 10	0.1 V	0.5 V
÷100	1 V	5 V

c. Adjust the trimmer capacitors so that the square waveform is flat under the following settings.

ATT	VOLTS/DIV	Square-wave generator output	Adjust
÷ 10	0.1 V	0.5 V	Comp-1/10
÷100	1 V	5 V	Comp-1/100

d. Move the signal to CH2 and set the VERT MODE switch to CH2.

e. Repeat b through c for CH2.

(20) Check/Adjust CH1, CH2 Input Capacity, (ATT: ÷10, ÷100)

a. Connect the L-C meter to the input terminal.

b. Check the input capacity for a approximately 23 pF.

c. Adjust the trimmer condensers for a 23 pF input capacity under the following settings.

ATT	VOLTS/DIV	Adjust CH1 (CH2)
÷ 1	10 mV	
÷ 10	0.1 V	Cin - 1/10
÷100	1 V	Cin - 1/100

(21) Check/Adjust CH3, CH4 Attenuator Compensation

a. Set:

VERT MODE CH3, CH4
CH3, CH4 .5V/DIV / .1V/DIV .... .5V/DIV (button in)
CH3, CH4 DC / AC .... DC (button in)

b. Connect the square-wave generator to CH3 input.

c. Check that a square wave is flat (flat top).

d. Adjust CV410 so that a square wave is flat at top.

e. Move the signal to CH4.

f. Check and adjust CV510 so that a square wave is flat at top.

(22) Check/Adjust CH3, CH4 Input Capacity

a. Set:

VERT MODE	CH3, CH4
CH3, CH4 .5 V/DIV .1 V/DIV	.5 V/DIV (button in)

b. Connect the L-C meter to CH3 (or CH4)

c. Check the input capacity for approximately 23 pF.

d. Adjust CV405 (or CV505 for DH4) for a 23 pF input capacity.

(23) Check/Adjust CH3, CH4 Step Response.

a. Set:

VERT MODE	CH3, CH4
CH3, CH4 .5 V/DIV .1 V/DIV	.5 V/DIV (button off)
A TIME/DIV	20 ns

b. Connect the fast-rise (less than 1 ns), positive output of the square-wave generator to the CH3 input. Use a 50-ohm termination and cable.

c. Set the square-wave generator to 1 MHz. Adjust the sqare-wave generator output for a 5-divisions display.

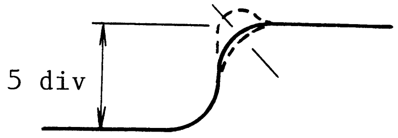
d. Check for over-shoot within ±0.35 division.

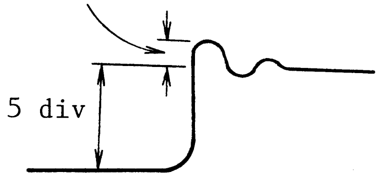
e. Adjust CV433 and RV434 for over-shoot within ±0.25 division.

f. Move the signal to CH4.

g. Check for over-shoot within ±0.35 division.

h. Adjust CV533 and RV534 for over-shoot that is within ±0.25 division.





TRIGGER

(24) Check/Adjust TRIG CENT

(1) A TRIG LEVEL CENT

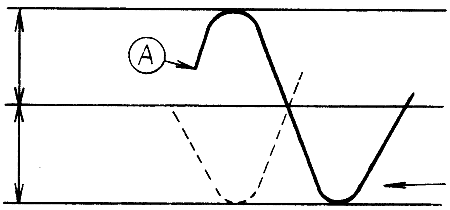
a. Set:

A TRIG SOURCE	CH1
A TRIG COUPLING	AC
A TRIG SLOPE	+
VERT MODE	CH1
VOLTS/DIV	10 mV/DIV
TIME/DIV	20 μs/DIV

b. Connect a sine-wave generator to the CH1 input and adjust the signal amplitude for 2 div (50 kHz).

c. Set the A TRIGGER LEVEL knob to the midposition.

d. Adjust RV902 so that the trigger is effected on the point A of the waveform.



(2) CH1 TRIG LEVEL CENT

e. Set the A TRIGGER COUPLING to DC.

f. Adjust RV104 so that the trigger is effected on the point A of the waveform.

(3) CH2 TRIG LEVEL CENT

g. Move the signal to CH2.

h. Change the VERT MODE switch to CH2 and A TRIGGER SOURCE to CH2.

i. Adjust RV304 so that the trigger is effected on the point A of the waveform.

(4) CH3 TRIG LEVEL CENT

j. Move the signal to CH3.

k. Set the VERT MODE switch to CH3.

l. Change the A TRIGGER SOURCE to CH3.

m. Set the 0.1 V/DIV, 0.5 V/DIV switch to the 0.1 V/DIV position for CH3.

n. Set the generator to 2 divisions display.

o. Adjust RV417 so that the trigger is effected on the point A of the waveform.

(5) CH4 TRIG LEVEL CENT

p. Move the signal to CH4.

q. Change the A TRIG SOURCE switch to CH4, and push both the QUAD and ALT buttons of VERT MODE.

r. Set the 0.1 V/DIV, 0.5 V/DIV switch to the 0.1 V/DIV position for CH4.

s. Adjust RV517 so that the trigger is effected on the point A of the waveform.

(6) B TRIG LEVEL CENT

a. Set:

VERT MODE	CH1	
VOLTS/DIV	10 mV/DIV	
A TIME/DIV	20 µs/DIV	
B TIME/DIV	5 µs/DIV	
A and B triggering	SOURCE :	CH1
	COUPLING:	AC
	B MODE :	NORM
	SLOPE :	+
Horizontal display mode	INTEN	
A and B TRIG LEVEL	Midposition	

b. Connect a sine-wave generator to the CH1 input for 2 div (50 kHz).

c. Adjust RV1101 so that the trigger is effected on the point A of the waveform.

(7) AUTO TRIG LEVEL

a. Set:

VERT MODE	CH1
VOLTS/DIV	10 mV/DIV
TRIG SOURCE	CH1
TRIG COUPLING	AC
TRIG SLOPE	+
TRIG MODE	AUTO
MENU SELECT	p-p AUTO ON

b. Apply a 4 div (50 kHz) signal to CH1 input.

c. Rotate the TRIG LEVEL control fully toward (+) side.

d. Adjust RV904 so that the upper side of the waveform is triggered.

e. Rotate the TRIG LEVEL control fully toward (-) side.

f. Adjust RV903 so that the lower side of the waveform is triggered.

g. When the signal amplitude is changed from 4 div to 8 div, check that the variable range of the trigger level changes according to the signal amplitude.

X-Y OPERATION

(25) Check/Adjust X Gain

a. Set:

CH1 VOLTS/DIV	10 mV/DIV
CH1 AC-GND-DC	AC
CH2 AC-GND-DC	DC
Horizontal display mode	XY

b. Connect the standard amplitude calibrator to CH1.

c. Set the standard amplitude calibrator for 50 mV.

d. Check that a display of 5 divisions is within ±3%.

e. Adjust RV1560 so that the display of 5 divisions is within ±1.5%.

(26) Check/Adjust X CENTer

a. Set:

CH1 AC-GND-DC	GND
Horizontal display mode	XY
Horizontal POSITION	Midrange

b. Check that a spot at the center vertical graticule line is within ±1.0 division.

c. Adjust RV125 so that the spot at the center vertical graticule line is within ±0.2 division.

SIGNAL OUTPUT

(27) Check/Adjust CAL

a. Jumper between 1 pin and 2 pin of P1607.

b. Connect a digital volt meter to the CAL terminal.

c. Check that the CAL output voltage is 0.495 V to 0.505 V.

d. Adjust RV1606 so that CAL output voltage is 0.495 V to 0.505 V.

(28) Check/Adjust CH2 OUT DC LEVEL

a. Set the CH1 AC-GND-DC switch to GND and the VERT MODE switch to CH2.

b. Connect a digital volt meter to the CH2 OUT terminal.

c. Check that the voltage 0 V is within ±0.1 V.

d. Adjust RV328 so that the voltage 0 V is within ±0.1 V.

READOUT & CURSOR

(29) Check/Adjust Readout gain.

a. Set READOUT INTENSITY control as required for well defined characters.

b. Set:

VERT MODE CH1
CURSOR, DLY/COUNTER .... CURSOR
CURSOR, mode V
Horizontal display mode .... A

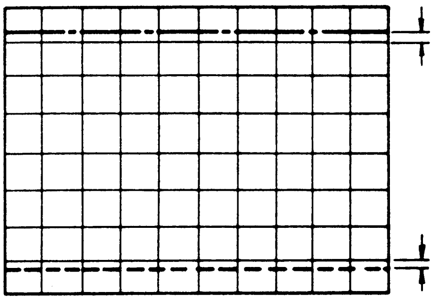
c. Jumper between 1 pin and 2 pin of P1607 (set in the calibration mode).

d. Check that delta and REF cursors are aligned with the horizontal graticule line within ±0.2 div. (see the below figure)

e. Adjust RV865 for 6 divisions between the delta and REF cursors.

f. Adjust RV874 so that the delta and REF cursors are aligned with the horizontal graticule line (see figure).

g. Repeat items e through f as required.



(30) Check/Adjust Cursor center

a. Set READOUT INTENSITY control as required for well defined characters.

b. Set:

VERT MODE	CH1
CURSOR, DLY/COUNTER	CURSOR
CURSOR mode	GND REF
Horizontal display mode	A
CH1 POSITION	midrange

c. Check that the GND REF CURSOR is aligned with the trace within 0.2 DIV.

d. Adjust RV892 as required.

(31) Check/Adjust CHR-X gain

a. Set READOUT INTENSITY control as required for well defined characters.

b. Set:

VERT mode	CH1
CURSOR, DLY/COUNTER	CURSOR
CURSOR mode	T
Horizontal display mode	A
TIME/DIV	1 ms/DIV

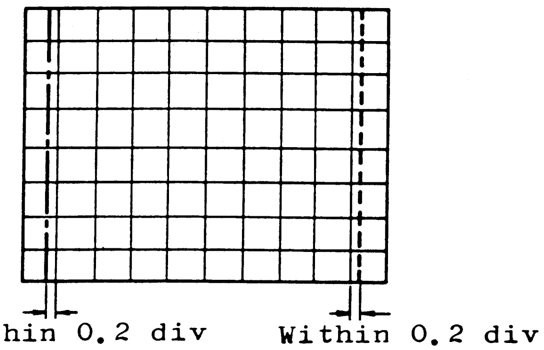
c. Jumper between 1 pin and 2 pin of P1607 (Set calibration mode).

d. Check that the delta and REF cursors are aligned with the vertical graticule line within 0.2 DIV (see the figure below).

e. Adjust RV1585 so that the delta and REF cursors are just aligned with vertical graticule line (see the figure below).

f. Adjust RV1573 so that the delta and REF cursors are aligned with the horizontal graticule line (see the figure below).

g. Repeat items e through f as required.



DVM

(32) Check/Adjust DVM function

(1) DCV

a. Set READOUT INTENSITY control as required for well defined characters.

b. Set:

VERT MODE	CH2
MENU SELECT	DVM
DVM mode	DCV
CH1 VOLTS/DIV	50 mV/DIV
CH1 AC-GND-DC	DC

c. Connect 250 mV DC voltage to CH1 input.

d. Check that the display on the upper side of CRT is 250 mV ±3.75 mV.

e. Adjust RV2571 as required.

(2) ACV

f. Set:

MENU SELECT	DVM
DVM mode	ACV
CH1 VOLTS/DIV	50 mV/DIV
CH1 AC-GND-DC	AC

g. Connect a 200 mVp-p 50 kHz sinewave to CH1 input.

h. Check that the display on the upper side of CRT is 70.7 mV ±5.3 mV.

i. Adjust RV2572 as required.

(Note)

$$Vrms = \frac{Vp\text{-}p}{2\sqrt{2}}$$

5. TEST AND EXERCISER

The oscilloscope is provided with service programs of "TEST" and "EXERCISER".

The setting procedure and its results are described below.

5.1 Setting procedure

1 Set the CURSOR/COUNTER key to the COUNTER.

2 Press the MENU key.

3 After the menu is displayed on the CRT, press the X10 MAG and the BLW keys simultaneously.

4 Then, "1. TEST, 2. EXERCISER" is displayed on the CRT.

5 Select the TRIGGER setting keys 1 and 2 to start the TEST and EXERCISER program, respectively.

Notes:

1) When TEST is selected, set the CH1 and CH2 to GND and do not apply signals.

2) Before starting TEST, perform initialization according to the procedures in the Operation Manual, and select the ΔV cursor and the GND REF functions.

5.2 Result

1. TEST

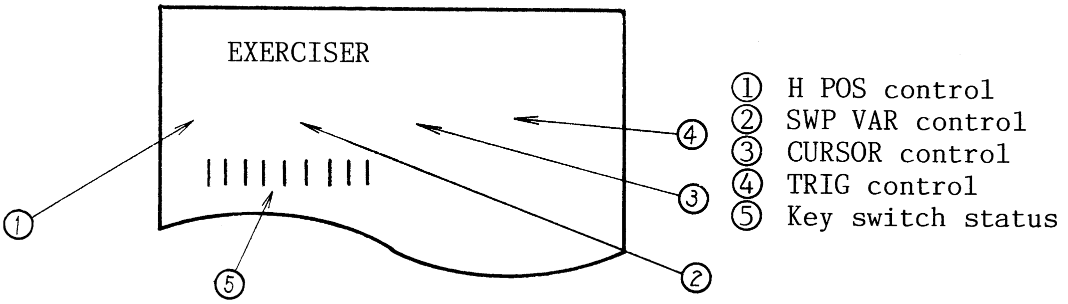
When no trouble is found to exit after completion of all the tests, "TEST PASS" is displayed on the CRT. When any malfunction is found, "FAIL NO." is displayed on the CRT.

FAIL NO.	TEST	Involved circuits	Involved connectors	Unit	Remarks
1	ROM sum check	DIGITAL CONTROL CKT	---	PEF-745	
2	RAM check	DIGITAL CONTROL CKT	---	PEF-745	
3	SW1 TEST (Check key operation)	PANEL CKT/ DIGITAL CONTROL CKT	P2000b-P2600	PEF-745/ PEF746	
4	SW2 TEST (Check ALT and CPL keys.)	DIGITAL CONTROL CKT/VPRE (ATT code output and its peripheral circuits)	P20001-P2010	PEF-745 PEF-734	
5	Control TEST (Check the HPOS,SWP VAR, CURSOR and TRIG controls)	DIGITAL CONTROL CKT/PANEL CKT	P2006-P2600	PEF-745	
6	COUNTER TEST	COUNTER CKT	P2003-P2030 P2004-P2040	PEF-745 PEF-738	
7	DVM TEST	DVM CKT	P1384-P1394 P2008-P1382 P601-P600	PEF-745 PEF-748 PEF-739	
8	GND REF TEST	GND REF CKT	P2003-P2030 P710-P711	PEF-745 PEF-737	
9	Shift register TEST (Check the transferred data between the DIGITAL CKT and the VPRE.)	DIGITAL CONTROL CKT/VPRE (IC2321 and its peripheral circuit)	P2002-P2020	PEF-745 PEF-734	

2. EXERCISER

When the EXERCISER program is selected, the control setting values and key switch status are displayed on the CRT.

Display example:



① and ② : Clockwise : 1FX

Counterclockwise : 00X

③ : 2X to FX approx.

④ : Clockwise : 00X

Counterclockwise : 1FX

Key and switch are allocated as shown below.

1	2	3	4	5	6	7	8	9
1	1	1	0	1	CURSOR	1	1	1
1	1	0	1	LF REJ	LINE	1	AC(TRIG)	CH2 INV
1	1	0	0	HF REJ	CH4(TRIG)	SGL	1	BW LIMT
1	0	1	1	TV-V	CH3(TRIG)	NORM	X10 MAG	ALT/CHOP
1	0	1	0	TV-H	A(TRIG)	AUTO	X-Y	CH4(VMODE)
1	0	0	1	DC	B(TRIG)	⊕	B(HDISP)	CH3(VMODE)

1	2	3	4	5	6	7	8	9
1	0	0	0	CH2(TRIG)	ALT(HDISP)	CH2(VMODE)	V	REF
0	1	1	1	CH1(TRIG)	A(HDISP)	CH1(VMODE)	T	Δ
0	0	0	0	ALT(TRIG)	INTEN	ADD	1/T	TRACKING

Notes:

1: 5 to 9 : One of them is "0", the rest is "1".

2: All is "1" when the switches are not pressed.

6. DETAILED CIRCUIT DESCRIPTION

1 CH1, 2 PREAMP (PEF-734)

Figure 6-1 shows a detailed block diagram of this circuit. This circuit consists of a CH1 vertical circuit and a CH2 vertical circuit. The operating principles of the both vertical circuits are identical and the description is made for the CH1 vertical circuit.

The CH1 signal (X signal in the X-Y mode) fed from J1 enters the CH1 INPUT COUPLING, where the coupling mode is selected by the AC-GND-DC switch S4. Then, the CH1 V signal is supplied to the CH1 1st ATTENUATOR and the signal level is attenuated to 1/1, 1/10 or 1/100 in accordance with the setting position of the VOLTS/DIV switch. This attenuation is required because an amplifier in the oscilloscope is designed for a small input signal and the gain of the amplifier is constant. The attenuated signal is fed to the CH1 INPUT AMP (high input impedance and low output impedance) and the impedance is converted.

Further description on the CH1 INPUT AMP is made, using Figure 6-2. The AC component of the CH1 V signal flows in the sequence of C11, TR12 gate, TR12 source, TR12 base and TR22 emitter. The DC component of the CH1 V signal flows in the sequence of R8, pin 3 of IC16, TR20 emitter, TR20 collector, TR22 base and TR22 emitter. Part of the DC component is negative fed back in the sequence of R24, pin 2 of IC16, TR20 emitter, TR20 collector and TR22. TR12 is a source-follower and the voltage gain is 1. Since TR22 is an emitter-follower, the voltage gain is 1.
IC16 is a DC amplifier. Since TR20 is base-grounded, it serves for the separation of an AC component and a DC component. In other words, it operates so that the AC component does not become a load to the DC component, and vice versa.

Though it is ideal that when the input to IC16 is zero, the output is zero, some voltage (called an offset voltage) is developed in an actual DC amplifier. CH1 DC BAL RV28 is provided to compensate for such an offset voltage and adjusts the DC input to pin 2 of IC16.
In other words, RV28 is adjusted so that a trace on the CRT does not move when the VOLTS/DIV switch (S4B) is selected. CH1 DC GAIN RV26 adjusts a DC feedback amount so that the DC gain matches the AC gain. In other words, RV26 is adjusted so that the output waveform is the same square wave as the input signal. D16 protects IC16 from a plus surge input. D14 and D15 protect FET TR12 from a minus surge input and a plus surge input, respectively. D22 protects TR22 from a minus surge input.

Now, let's return to the description on Figure 6-1. The CH1 V signal from the CH1 INPUT AMP enters the CH1 2ND ATTENUATOR and the signal level is attenuated to 1/1, 1/2, 1/4 or 1/10 in accordance with the setting position of the VOLTS/DIV switch. The output impedance of the attenuated signal is approximately 150 ohms. Then, the CH1 V signal enters CH1 PREAMP IC50, where the signal is amplified to 6.25 times when the VOLTS/DIV switch is at 2 mV, and to 2.5 times when the switch is at the position other than 2 mV.

The CH1 V signal fed out from the CH1 PREAMP is fed out from [7] via CH1 VAR RV51. RV51 is in the CAL state at the position when R60 is shorted. When RV51 is turned fully to UNCAL, the CH1 V signal level is less than 1/2.5 times the value at the CAL state. The information on the CAL or UNCAL setting and the input signal coupling mode is delivered as the CH1-2 signal to the microcomputer via [1] .

The switches S4D and S4d of the VOLTS/DIV INF CIRCUIT (1) are switched in accordance with the VOLTS/DIV switch. The sum of the current flowing through R2704, R2705, R2706 and R2707 varies according to the switch selection. The difference in the current is converted into a difference in a voltage by the PANEL STATUS (1). This converted signal is the CH1-1 signal. In other words, the information on the VOLTS/DIV switch setting is delivered as the CH1-1 signal to the microcomputer via [3] .

The CH1 GND CONT signal whose level becomes "H" at a certain interval is delivered to the RELAY DRIVE CIRCUIT (1) from the microcomputer via [5] . When the CH1 GND CONT signal is "H", TR2300 is on and relay K2300 is activated.
The input of the CH1 PREAMP is thus grounded and the GND reference line can be displayed on the CRT.
S4, S4A, S4B, S4C, S4D, S4d, INPUT COUPLING, 1ST ATTENUATOR and 2ND ATTENUATOR constitute an attenuator block. C_{01}, which is not describ-ed on the schematic diagram, is incorporated in the attenuator block. Table 6-1 shows the relationship between the overall gain and the VOLTS/DIV switch.

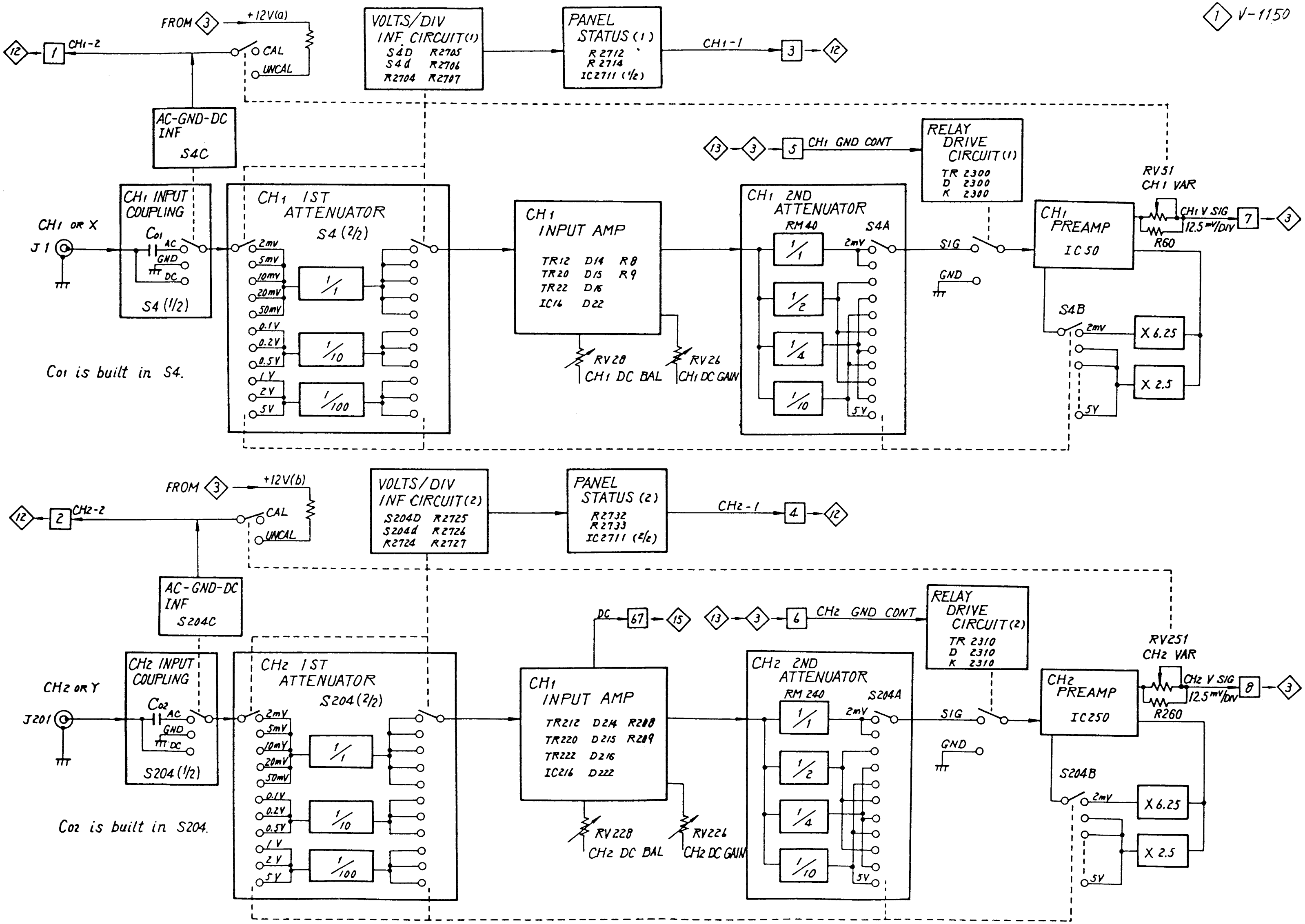

V-1150
FROM 3
+12V(a)
CH1-2
CAL
UNCAL
VOLTS/DIV INF CIRCUIT(1)
S4D R2705
S4d R2706
R2704 R2707
PANEL STATUS (1)
R2712
R2714
IC2711 (1/2)
CH1-1
AC-GND-DC INF S4C
CH1 GND CONT
RELAY DRIVE CIRCUIT (1)
TR 2300
D 2300
K 2300
RV51
CH1 VAR
CH1 OR X
J1
CH1 INPUT COUPLING
C01
AC
GND
DC
S4 (1/2)
CH1 1ST ATTENUATOR
S4 (2/2)
2mV
5mV
10mV
20mV
50mV
0.1V
0.2V
0.5V
1V
2V
5V
1/1
1/10
1/100
CH1 INPUT AMP
TR12 D14 R8
TR20 D15 R9
TR22 D16
IC16 D22
RV28
CH1 DC BAL
RV26
CH1 DC GAIN
CH1 2ND ATTENUATOR
RM40
S4A
1/1
1/2
1/4
1/10
SIG
GND
CH1 PREAMP
IC50
CH1 V SIG
12.5mV/DIV
R60
S4B
X 6.25
X 2.5
C01 is built in S4.
FROM 3
+12V(b)
CH2-2
CAL
UNCAL
VOLTS/DIV INF CIRCUIT(2)
S204D R2725
S204d R2726
R2724 R2727
PANEL STATUS (2)
R2732
R2733
IC2711 (2/2)
CH2-1
AC-GND-DC INF S204C
DC
CH2 GND CONT
RELAY DRIVE CIRCUIT (2)
TR 2310
D 2310
K 2310
RV251
CH2 VAR
CH2 OR Y
J201
CH2 INPUT COUPLING
C02
S204 (1/2)
CH2 1ST ATTENUATOR
S204 (2/2)
CH1 INPUT AMP
TR212 D214 R208
TR220 D215 R209
TR222 D216
IC216 D222
RV228
CH2 DC BAL
RV226
CH2 DC GAIN
CH2 2ND ATTENUATOR
RM 240
S204A
CH2 PREAMP
IC250
CH2 V SIG
12.5mV/DIV
R260
S204B
C02 is built in S204.

Fig. 6-1

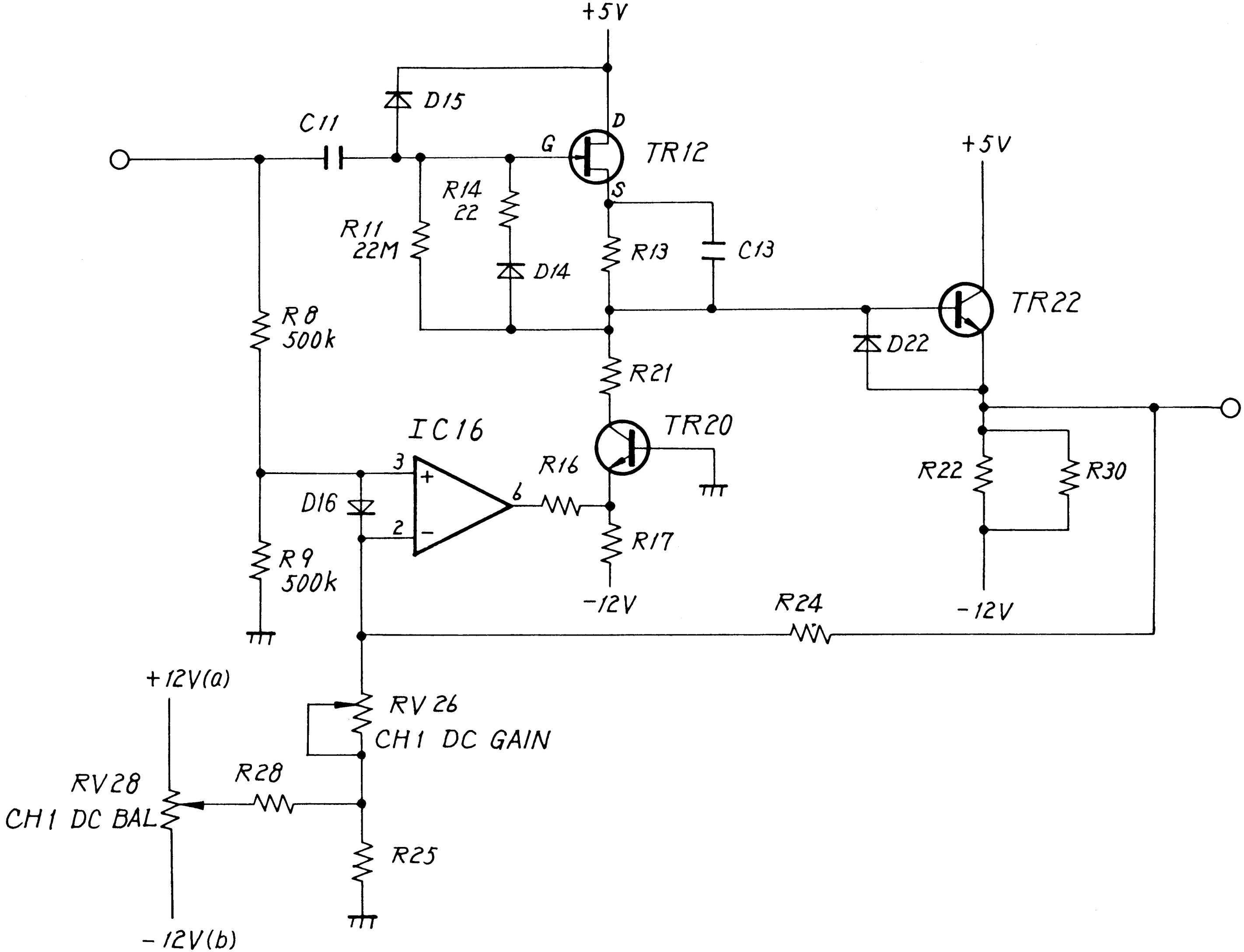

+5V
D15
C11
D
G
TR12
S
R14
22
R11
22M
R13
C13
D14
+5V
TR22
R8
500k
D22
R21
IC16
TR20
3
+
R16
R22
R30
D16
6
2
−
R17
R9
500k
−12V
R24
−12V
+12V(a)
RV26
CH1 DC GAIN
RV28
R28
CH1 DC BAL
R25
−12V(b)

Fig. 6-2

1 V-1150

Table 6-1

VOLTS/DIV SW Position	1st Attenuator	INPUT AMP Gain	2nd Attenuator	CH1 PREAMP Gain	Overall Gain (approx.)	VOLTS/DIV x Overall Gain
2 mV	1	1	1	6.25	6.25	12.5 mV/div
5 mV	1	1	1	2.5	2.5	12.5 mV/div
10 mV	1	1	0.5 (÷2)	2.5	1.25	12.5 mV/div
20 mV	1	1	0.25 (÷4)	2.5	0.625	12.5 mV/div
50 mV	1	1	0.1 (÷10)	2.5	0.25	12.5 mV/div
0.1 V	0.1 (÷10)	1	0.5 (÷2)	2.5	0.125	12.5 mV/div
0.2 V	0.1 (÷10)	1	0.25 (÷4)	2.5	0.0625	12.5 mV/div
0.5 V	0.1 (÷10)	1	0.1 (÷10)	2.5	0.025	12.5 mV/div
1 V	0.01 (÷100)	1	0.5 (÷2)	2.5	0.0125	12.5 mV/div
2 V	0.01 (÷100)	1	0.25 (÷4)	2.5	0.00625	12.5 mV/div
5 V	0.01 (÷100)	1	0.1 (÷10)	2.5	0.0025	12.5 mV/div

⟨2⟩ CH3, CH4 PREAMP (PEF-733)

Figure 6-3 shows a detailed block diagram of this circuit. This circuit consists of a CH3 circuit and a CH4 circuit. Since the both circuits are identical, the description is made on the CH3 circuit. CH3 POS RV470 and CH4 POS RV570 are described in the Figure 6-4 Detailed Block Diagram of ⟨3⟩.
The CH3 signal fed from J400 enters the CH3 INPUT COUPLING and the AC- or DC- coupled signal is fed to the CH3 ATTENUATOR, where the signal is attenuated to 1/1 or 1/5. The attenuated CH3 signal is fed to the CH3 INPUT AMP (high input impedance and low output impedance) and the impedance is connected.

TR413A and TR413B are the same type of FET and the drift in temperature is suppressed. TR413 is a source-follower and the gain is 1. TR420 is an emitter-follower and the gain is 1. D409 is a diode which protects the FET from a minus surge input.

The output of the CH3 INPUT AMP is fed to TR430. This transistor is an emitter follower and operates as a buffer circuit. One output of TR430 is fed out from [9] as a CH3 TRIG signal. The other is fed out from [10] as a CH3 signal.

Though the DC level at the TR420 emitter is higher by V_{BE} than that at the TR420 base, the DC level is reduced by V_{BE} by TR450. Consequently, the DC level at TR420 base is regarded as same as that at the TR450 emitter. The V_{BE}'s of TR420 and TR430 suppress the drift in temperature.

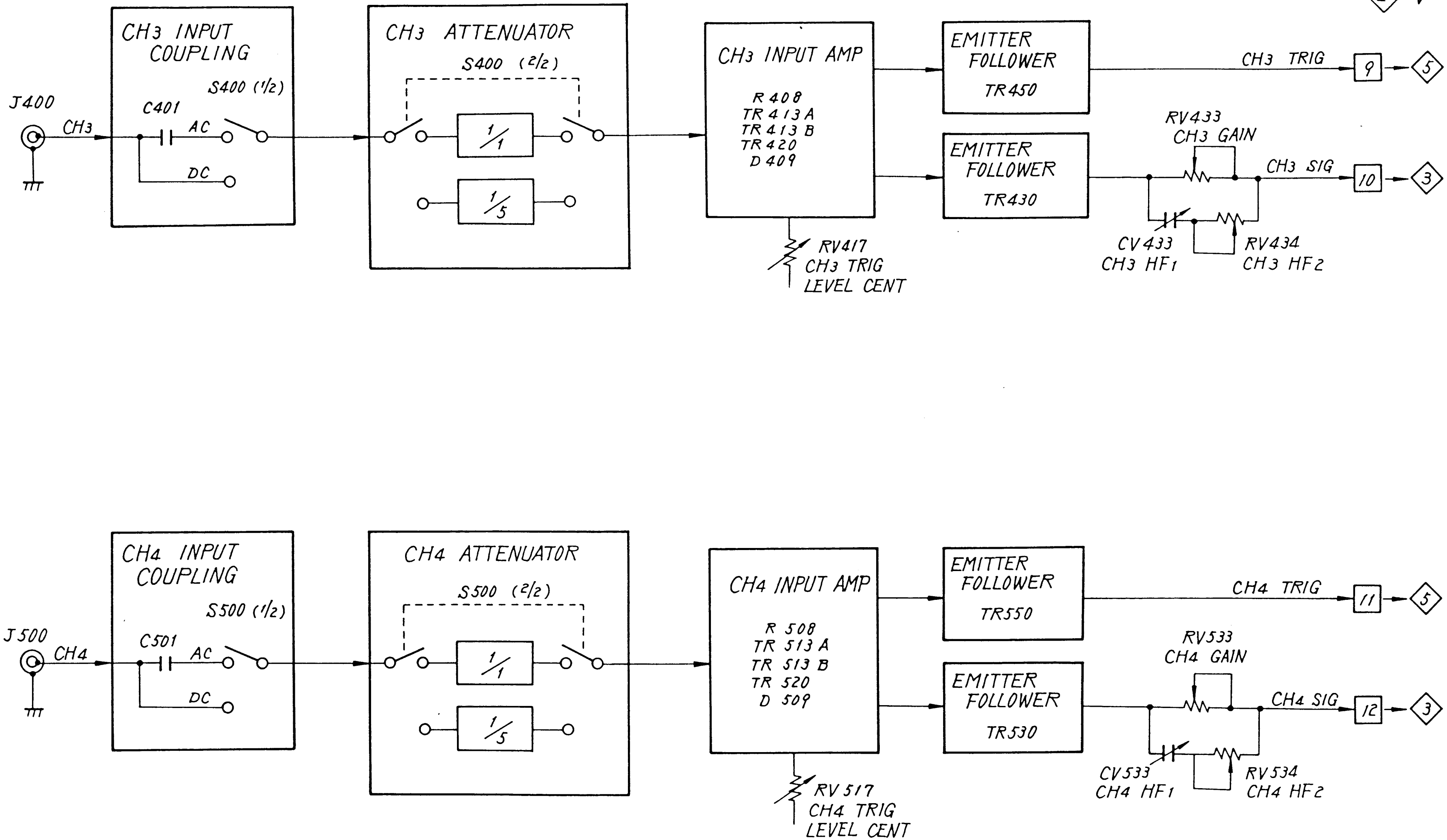

CH3 INPUT COUPLING
J400
CH3
C401
S400 (1/2)
AC
DC
CH3 ATTENUATOR
S400 (2/2)
1/1
1/5
CH3 INPUT AMP
R408
TR413A
TR413B
TR420
D409
RV417
CH3 TRIG
LEVEL CENT
EMITTER FOLLOWER
TR450
EMITTER FOLLOWER
TR430
CH3 TRIG
9
5
RV433
CH3 GAIN
CH3 SIG
10
3
CV433
CH3 HF1
RV434
CH3 HF2
CH4 INPUT COUPLING
J500
CH4
C501
S500 (1/2)
AC
DC
CH4 ATTENUATOR
S500 (2/2)
1/1
1/5
CH4 INPUT AMP
R 508
TR 513 A
TR 513 B
TR 520
D 509
RV 517
CH4 TRIG
LEVEL CENT
EMITTER FOLLOWER
TR550
EMITTER FOLLOWER
TR530
CH4 TRIG
11
5
RV533
CH4 GAIN
CH4 SIG
12
3
CV533
CH4 HF1
RV534
CH4 HF2

Fig. 6-3

◇3 VERTICAL SWITCHING (PEF-734)

Figure 6-4 shows a detailed block diagram of this circuit. The CH1 V signal fed from [7] is amplified to 2.5 times the supplied voltage by X2.5 AMP(1) IC80 and fed to pin 3 of CH SW CIRCUIT IC150.
Part of the amplified signal enters X2.5 AMP(2) IC100 and is further amplified to 2.5 times the supplied voltage.

The output of IC100 is fed out from [17] as the CH1 TRIG signal. IC2950 (2/2) in ◇11 is a voltage follower and operates as a buffer. Consequently, the DC voltage set by CH1 POS control RV2952 is the output voltage of IC2950 (2/2). The DC voltage corresponding to the output voltage is routed to pin 4 of CH SW CIRCUIT IC150 and changes the vertical position of the CH1 V signal.

In the operating modes other than the X-Y mode, $\overline{\text{X-Y}}$ signal level is "H". Consequently, TR122 turns to on and the base of TR120 is grounded. In the X-Y mode, TR122 is off and the X signal fed from [7] is routed to [20] via X2.5 AMP(1) → X2.5 AMP(2) → TR109 → TR120 base → TR120 collector. The position in the X direction (horizontal direction) in the X-Y mode is adjusted by CH1 POS control RV2952. Adjust X CENT control RV125 so that the position in the X direction of the spot comes to the center graticule (horizontal direction), when RV2952 is set to the mid-position of its variable range.

Since the output impedance of IC2950 (2/2) is extremely small, X CENT RV125 and CH1 POS CENT RV140 do not interact. The DC voltage which determines the position in the X direction is routed to [20] via CH1 POS RV2952 → IC2950 (2/2) → R123 → TR121 → TR120. The temperature compensation against V_{BE} is done by TR120 and TR121.

The CH2 V signal fed from [8] is amplified to 2.5 times the supplied voltage by X2.5 AMP(3) and routed to pin 7 of CH SW CIRCUIT IC150. Part of the output of IC280 is further amplified to 2.5 times the supplied voltage by X2.5 AMP(4) IC300 and is fed out from [18] as a CH2 TRIG signal. Part of the output of IC300 is fed out from CH2 OUT J201 as the CH2 signal via a buffer consisting of TR320 and D321. Part of the output of IC300 is fed to the ◇15 DVM circuit.

The CH3 signal and the CH4 signal enter CH SW CIRCUIT IC150 at pins 11 and 15, respectively. The DC voltages which determine the vertical positions of CH2, CH3 and CH4 are fed to pins 8, 12 and 16 of IC150. The signals fed from the ◇9 Z AXIS & CRT CONTROL circuit to 24 , [25] , [26] and [27] enter CH SW CIRCUIT IC150 at pins 32, 31, 24 and 23, respectively, via CH SW CONTROL IC2320. Among these control signals, only the channels corresponding to the signals which turn to "L" are selected and fed out from [22] and [23] via the DELAY LINE.

For example, if the $\overline{\text{CH1 EN}}$ and $\overline{\text{CH2 EN}}$ signals are "L", the CH1 signal fed from pin 3 and the CH2 signal fed from pin 7 are selected. When characters are displayed, the $\overline{\text{CHR EN}}$ signal from [28] turns to "L". Consequently, the $\overline{\text{CH1 EN}}$, $\overline{\text{CH2 EN}}$, $\overline{\text{CH3 EN}}$ and $\overline{\text{CH4 EN}}$ signals turn to "H", neither of the channels is selected and no signal is delivered from [22] and [23] .

SHIFT REGISTER IC2321 performs a serial-parallel conversion (1 bit - 3 bits). The DB ϕ data fed from [29] is supplied to Q_{0A}, using the rising portion of the clock pulse SHIFT CK3 fed from [30]. In this case, the data at Q_{0A} and Q_{1A} are shifted to Q_{1A} and Q_{2A}, respectively. In the X-Y mode, $\overline{\text{X-Y}}$ turns to "L". When the CH2 signal is inverted, $\overline{\text{CH2 INV}}$ turns to "L". In the X10 MAG mode, $\overline{\text{X10 MAG}}$ turns to "L". Part of the output of Q_{2A} is fed out from [31] as the CHECK 1 signal. This signal is used to check if connector P2020 of ◇3 and connector P2002 of ◇13 are connected or not.

A SWP-1 and A SWP-2 are the signals which inform the microcomputer of the state of the TIME/DIV switch for A SWEEP. The setting state of the switch is represented by a difference in voltage. The microcomputer recognizes the setting position of the TIME/DIV switch by reading the voltage value.
B SWP-1 and B SWP-2 are the signals which inform the microcomputer of the state of the TIME/DIV switch for B SWEEP.

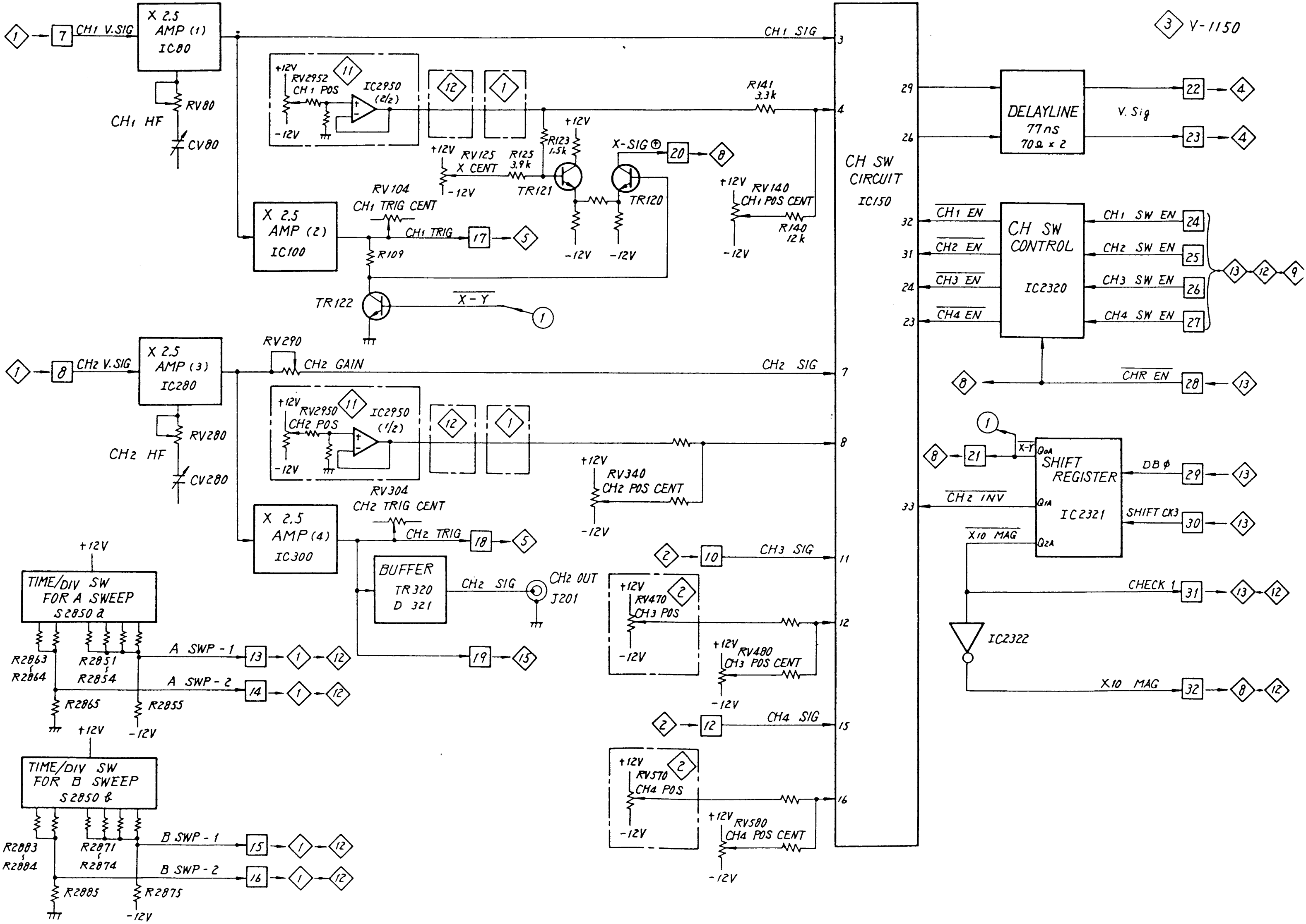

V-1150
CH1 V.SIG
X 2.5 AMP (1) IC80
CH1 SIG
RV80
CH1 HF
CV80
+12V
RV2952 CH1 POS
IC2950 (2/2)
-12V
R141 3.3k
R123 1.5k
X-SIG ⊕
RV125 X CENT
R125 3.9k
TR121
TR120
RV140 CH1 POS CENT
R140 12k
RV104 CH1 TRIG CENT
X 2.5 AMP (2) IC100
CH1 TRIG
R109
TR122
X-Y
RV290
CH2 GAIN
CH2 V.SIG
X 2.5 AMP (3) IC280
CH2 SIG
RV280
CH2 HF
CV280
RV2950 CH2 POS
IC2950 (1/2)
RV340 CH2 POS CENT
RV304 CH2 TRIG CENT
X 2.5 AMP (4) IC300
CH2 TRIG
BUFFER TR320 D 321
CH2 SIG
CH2 OUT J201
CH3 SIG
RV470 CH3 POS
RV480 CH3 POS CENT
CH4 SIG
RV570 CH4 POS
RV580 CH4 POS CENT
CH SW CIRCUIT IC150
DELAYLINE 77ns 70Ω x 2
V. Sig
CH SW CONTROL IC2320
CH1 EN
CH2 EN
CH3 EN
CH4 EN
CH1 SW EN
CH2 SW EN
CH3 SW EN
CH4 SW EN
CHR EN
SHIFT REGISTER IC2321
X-Y
DB ϕ
CH2 INV
SHIFT CK3
X10 MAG
CHECK 1
IC2322
X10 MAG
TIME/DIV SW FOR A SWEEP S2850 a
R2863 R2864
R2851 R2854
R2865
R2855
A SWP - 1
A SWP - 2
TIME/DIV SW FOR B SWEEP S2850 b
R2883 R2884
R2871 R2874
R2885
R2875
B SWP - 1
B SWP - 2

Fig. 6-4

⟨4⟩ VERTICAL OUTPUT AMP & GND REFERENCE CKT (PEF-737)

Figure 6-5 shows the detailed block diagram of this circuit. A vertical signal (an X signal in the X-Y mode) fed from [22] and [23] enters the BANDWIDTH LIMITER (BWL) via the CASCODE AMP 1. The BWL consists of an analog switch and capacitors C729 and C730.

The analog switch consists of D729a, D729b, D730a, and D730b. Usually the analog switch is off and the BWL does not operate. The BWL operates only when the BW LIMIT/20MHz switch on the front panel is pressed, and a high frequency of 20 MHz or more is limited. In other words, the BWL signal from [36] becomes "H" when the BW LIMIT/20MHz switch is pressed, and switching transistor TR814 becomes on. As a result, electric potential at point (b) in the analog switch becomes lower than that at point (a) , the analog switch becomes on, and points (c) and (d) are shorted. Then, the BWL circuit operates.

The vertical signal from the BWL enters CRT DRIVER IC760 via the CASCODE AMP 2. Transistors composing IC760 are connected in parallel to allow a large current to flow.
The output from the CRT DRIVER is fed out to the Y-plate of the CRT from [41] and [42] via 15V zener diodes D765 and D766 so that the DC potential from the CRT DRIVER matches with the rated DC potential of the CRT.

The DC voltage (A/B SEP signal) set by A/B TRACE SEP RV2951 in the circuit ⟨11⟩ enters the ALT SEP CIRCUIT, which makes the vertical position of A SWEEP different from that of B SWEEP. Usually the A/B SEP CONT signal from [34] is "H." TR804 becomes on and D801 becomes off. Consequently, the base voltage of TR807 is not affected by the DC voltage of the A/B SEP signal from [33] . In other words, the ALT SEP CIRCUIT does not operate.

In case of the character display, the CHR EN from [35] becomes "H", and switching transistor TR821 becomes on. As a result, the emitter voltage (level) of TR821 rises, and TR804 is forced to become on to disable the ALT SEP CIRCUIT.
(TR804 becomes on regardless of the level of the A/B SEP CONT signal.)

Consequently, the ALT SEP CIRCUIT does not operate "when the ALT SEP operation is not performed" or "when the characters are displayed."
In this case, the base potential of TR807 and TR808 is grounded, the values of the current flowing to the collectors of both transistors are equal.

When the ALT SEP operation is performed, an A/B SEP CONT pulse is supplied to the ALT SEP CIRCUIT. (In this case, the CHR EN from [35] is "L" and TR821 is off.) The A/B SEP CONT pulse is "H" for A SWEEP and TR804 is on, and the pulse is "L" for B SWEEP and TR804 is off.
When TR804 is off, the base voltage of TR807 is determined by the DC voltage (A/B SEP) from [33] and the collector current of TR807 is different from that of TR808. As a result, the vertical positions of the A SWEEP and the B SWEEP are different each other.

D801 ensures the switching separation. TRACE FINDER S1710 in the circuit ⟨7⟩ switches the TRACE FIND function. The TRACE FIND function reduces the bias current of the horizontal and the vertical amplifiers to control their amplitudes so that their maximum amplitudes are within the screen of the CRT.

The TRACE FIND function for the vertical amplifier is described below: Usually S1710 is directly connected to the voltage of -12 V and the emitter current I_E of the differential amplifier consisting of TR737 and TR740 becomes I_{E1} which is determined by R737, R739, R740, and R742. (TR852 is off since its base potential is -12 V.)
S1710 is open when TRACE FINDER S1710 on the front panel continues to be pressed, and I_E becomes I_{E2} which is determined by R737, R739, R740, R742, and R851. That is, I_E decreases in accordance with an increase of the current across R851, the amplitude of the differential amplifier is limited, and the vertical TRACE FIND functions. In this case, the voltage of I_{E2} x R851 is supplied to the base of TR852, and TR852 becomes on.

(1) When TR852 becomes on, the collector current flows through R749 and R750. The collector bias current of TR745 and TR746 which have changed by the decrease of I_E is restored. Therefore, the collector bias current is controlled to be constant by TR852 regardless of the TRACE FIND function.

The $\overline{\text{CHR EN}}$ from [37] is "L" for the character display, and is "H" for the waveform display. The $\overline{\text{CHR EN}}$ is supplied to the base of TR855 via emitter follower TR860. TR855 is off and TR862 is on for the character display, and TR855 is on and TR862 is off for the waveform display. TR855 and TR862 are current switches. When TR862 becomes on, the character amplifier consisting of TR864 and TR865 becomes on, a CHR Y signal (which determines the vertical position of the character signal) from the base of TR865 is supplied to each collector of TR745 and TR746 through the character amplifier. That is, the current I_{WAV} flows through TR855 via R749 and R750 for the waveform display, and no current flows for the character display.
On the other hand, no current flows through TR865 for the waveform display, and the current I_{CHR} flows through TR862 via R755 and R758. Therefore,

(2) Each collector bias current of TR745 and TR746 is constant for both waveform display and the character display.

As described in (1) and (2), the character display position is almost constant regardless of the TRACE FIND function.

The GND REFERENCE CIRCUIT consisting of IC871(2/2), IC888, IC891, C889, and D886 allows the ground reference line to be displayed on the screen of the CRT. The vertical position on the screen is determined by the DC potential difference between the two output lines from the CRT DRIVER. In other words, the vertical position of the trace on the screen is known by the DC potential difference when the input coupling condition in the circuit ⟨1⟩ is GND.

The DC difference voltage is supplied to differential amplifier IC871(2/2) to be converted from a paraphase signal to a single-ended signal, and to be adjusted to the signal level suitable for the input operational range of comparator IC888 at the next stage. That is, IC871(2/2) operates as a buffer and the DC difference voltage is fed out from its output terminal. The output, in accordance with the GND level, is supplied to (+) terminal of IC888 and IC891. The GND SMPL from the microcomputer via [43] is a control signal for switching sample holder IC891 to on or off.

The condition that sample holder IC891 is on is called a "track mode," and the voltage corresponding to the output voltage i.e. the ground level (analog signal) of IC871(2/2) is held to analog memory C889.
The condition that sample holder IC891 is off is a "hold mode." In the hold mode, comparator IC888 compares the hold voltage of C889 with the half voltage of the full scale of the D/A converter in the circuit ⟨13⟩ , and sets the GND A/D from [40] to "H" or "L." Then, IC888 compares the hold voltage of C889 with the one-fourth voltage of the full scale of the D/A converter.

By repeating the above comparisons 12 times, the GND level is converted from an analog signal to a digital signal. That is, a successive approximation conversion to a digital signal is performed. The digitized GND level is stored in the RAM in the circuit ⟨12⟩ , and the GND reference line is displayed on the screen of the CRT. Whenever relay K2300 (K2310) selects GND of the input of the CH1 (CH2) PREAMP, the above mentioned conversion is performed, and the GND reference line is renewed.

5 A & B TRIG SELECTOR (PEF-738 1/3)

Figure 6-6 shows a detailed block diagram of this circuit. The TRIG SIG from [17], [18], [9], and [11] are supplied to TRIGGER SELECTOR 1 IC901 and TRIGGER SELECTOR 2 IC1101 which select trigger sources of A TRIG and B TRIG, respectively. The two selectors use same ICs, UH-207. The UH-207 incorporates an analog switch for 5-channel switching and a 4X amplifier and a bandwidth can be switched between 150 MHz and 20 MHz by the $\overline{BWL}$ signal. (When the $\overline{BWL}$ signal is "L," the bandwidth of 20 MHz is selected.) The TRIGGER SELECTOR 1 uses four channels and the remaining one channel is not used.

A control signal fed to terminal A, B, or C determines the channel to be selected. See Tables 6-2 and 6-3 for details of the TRIGGER SELECTOR 1 and the TRIGGER SELECTOR 2, respectively.

The output signal from the TRIGGER SELECTOR 1 always flows through the PATH A and the PATH B. The signal is selected at the following stage of each path, and is determined whether the signal is used as the A TRIG SIG or not. Only when the trigger coupling mode is TV-V, or TV-H, the signal which has passed the PATH A becomes effective. In other modes, excluding the LINE mode, the signal which has passed the PATH B becomes effective. In the DC, AC, or LF REJ mode, the output signal (trigger signal) flows PATH C, too. In the LINE mode, the LINE SIG from [105] becomes the trigger signal.

IC1103c is an analog switch for reversing a signal polarity. The TV POLA signal fed out from I/O EXPANDER controls the switching operation. When the TV POLA signal is "H," terminals Z and Z_1 are connected, and terminal (-) of IC1102b is grounded so that a signal is supplied to terminal (+) of IC1102b via R958. Therefore, the polarity of the signal is not reversed. When the TV POLA signal is "L," terminals Z and Z_0 are connected, and a signal is supplied to terminal (-) of IC1102b via R957. Therefore, the polarity is reversed.

The trigger signal in the TV-V or the TV-H mode is supplied to the SYNC SEPARATOR via IC1102b. TR905 and D903 separate a sync component from the composite TV signal. IC911d is used as a waveform shaper.
The output from IC911d is the TV-H signal (a composite sync signal including the horizontal and the vertical sync signals).

When the composite sync signal passes through the low pass filter consisting of L901 and C923, the TV-V signal including only the vertical sync signal is obtained at the output.

IC905 is an analog switch for switching the trigger coupling mode. A control signal from terminal A, B, or C determines the mode to be a selected. IC1103a is an analog switch, and is controlled by the output signal from IC911a. The output signal from IC911a is controlled by the A CPL SEL 1, the A CPL SEL 2, and the A CPL SEL 3 signals. Only when the trigger coupling mode is TV-H, the output signal from IC911a becomes "H," and terminals X and X_0 are connected. In other modes, the output signal is "L," and terminals X and X_1 are connected.

Relay K906 is controlled by the A CPL SEL 3 signal. When the A CPL SEL 3 signal is "L," no drive current flows in the RELAY DRIVER, and pins 1 and 4 of K906 are connected. When the A CPL SEL 3 is "H," a drive current flows in the RELAY DRIVER, and pins 7 and 4 of K906 are connected.

Table 6-4 shows the relationship between the setting positions of analog switches IC905 and IC1103a, relay K906 and the control signals A CPL SEL 1, A CPL SEL 2, and A CPL SEL 3.
IC903a, IC903b, and IC1102a are buffer circuits.

Circuit operations in each trigger coupling mode are described below:

(1) DC mode

The TRIG SIG flows in the sequence of

IC901 → C903 → [52] .
└→ R907 → IC905(X_0) → IC903b → R926 ┘

(2) AC mode

The TRIG SIG flows in the sequence of

IC901 → C903 → [52] .
└→ R907 → C925 → IC905(X_1) → IC903b → R926 ┘

That is, the TRIG SIG flows through the parallel circuits of C903 and C925.

(3) LF REJ mode

The TRIG SIG flows in the sequence of

IC901 → K906(pin 1 → pin 4) → C903, and is fed out from [52] .

L926 is grounded via IC903b since X_2 and X of IC905 are connected. Then, the TRIG SIG passes the high pass filter consisting of C903, R926, and L926. As a result, only the signal of several tens of kilohertz or more passes in this mode, while the signal of several tens of hertz or more passes in the AC mode.

(4) HF REJ mode

The TRIG SIG flows in the sequence of

IC901 → R907 → C925 → IC905(X_4) → IC903b → R926, and is fed out from [52] .

C903 is grounded via IC903a since pins 4 and 7 of K906 are connected, and terminals X and X_1 of IC1103a are connected. As a result, the TRIG SIG passes the low pass filter consisting of L926, R926, and C903.

(5) LINE mode

The LINE SIG from [105] is used as the TRIG SIG in this mode. The LINE SIG (TRIG SIG) flows in the sequence of

IC905(X5) → IC903b → R926, and is fed out from [52] .

The LINE SIG passes the low pass filter consisting of L926, R926, and C903 in the same way as the HF REJ mode.

(6) TV-V mode

The TRIG SIG flows in the sequence of

IC901 → R952 → R957 or R958 → IC1102b → SYNC SEP → IC905(X6) → IC903b → R926, and is fed out from [52] .

The TRIG SIG (TV-V signal) passes the low pass filter in the same way as the HF REJ and the LINE modes.

(7) TV-H mode

The TRIG SIG (TV-H) flows in the sequence of

IC901 → R952 → R957 or R958 → IC1102b → SYNC SEP
→ IC1103a(X_0 → X) → IC903a → K906(pin 7 → pin 4) → C903 → [52]
→ IC905(X_7) → IC903b → R926 ————————————————┘

Part of the TV-H signal is supplied to the TRIGGER SELECTOR 2.

IC1103b is an analog switch for switching the trigger coupling mode of the B TRIG SIG. The B CPL SEL signal controls the analog switch. When the B CPL SEL signal is "L," terminal Y and Y_0 are connected, and the DC mode is established.
When the B CPL SEL signal is "H," terminal Y and Y_1 are connected, and the AC mode is established.

In the DC mode, the B TRIG SIG flows in the sequence of IC1101 → R1107 → IC1103b(Y_0 → Y) → IC1102a → R1115, and is fed out from [46] .
In the AC mode, the B TRIG SIG passes through the parallel circuit consisting of C1103 and C1111, and is fed out from [46] .

As shown in Figure 6-6, D906, D907, and TR910 constitute a circuit equivalent to a negative OR circuit.

The A SCE SEL 3 signal which is one of the input signals to the OR circuit is always "L" and its output is "H." The A SCE SEL 3 is "H" only when the V. MODE switch is set to ALT, and the output from the OR circuit is determined by the $\overline{\text{CH1 EN}}$ signal from [45] .
When the V. MODE switch is at ALT, the $\overline{\text{CH1 EN}}$ signal alternately becomes "H" and "L" so that the trigger source is switched to CH1 and CH2. (In this oscilloscope, the ALT TRIG operation is performed for the CH1 and CH2, excluding for CH3 and CH4.) When the V. MODE switch is at CHOP, the trigger source is CH1.

I/O EXPANDER IC2340 functions as an output port in this circuit.
IC2340 consists of four output ports ① , ② , ③ , ④ as shown in Figure 6-6. The PROG signal from [59] controls the output port to which the data (DB0, DB1, DB2, and DB3) from the microcomputer is supplied.

One of output ports ① , ② , ③ , and ④ is selected at the rising portion of the PROG signal, and the data are supplied to the selected output port at the falling portion of the $\overline{\text{PROG}}$ signal.
The microcomputer selects IC2340 by setting the $\overline{\text{CS1}}$ signal from [60] to "L."

Part of A TRIG SIG is supplied to the (+) PEAK DETECTOR and the (-) PEAK DETECTOR via R936. Then, the (+) peak current and the (-) peak current of the A TRIG SIG are supplied from [53] and [54] , respectively.
These detector circuits and other circuits are described below by using Figure 6-7.
When the A TRIG SIG is supplied to TR901, a charging current flows across capacitors C915//C926 in the direction of arrow ⇨ via R938 (10 ohms).

On the other hand, a discharging current flows in the direction of arrow ----→ via R939 (470 kilohms) so that the time constant of the discharge becomes very large. As a result, the (+) peak voltage is held at C915//C926, and is supplied to voltage follower IC907a as a +Vp (a DC voltage).

The V_{BE} of TR908 compensates for the DC voltage drop by the V_{BE} of TR901. +Vp ADJ control RV904 adjusts the (+) peak voltage of the A TRIG SIG at the base of TR901 to be equal to the output (the DC voltage) of IC907a. The (-) peak voltage of the A TRIG SIG is detected in the same way as the (+) peak voltage. However, the (+) peak voltage is detected at charging, and the (-) peak voltage is detected at discharging.

The (+) peak voltage (+Vp) and the (-) peak voltage (-Vp) are supplied to the analog switch in the circuit ⟨11⟩. The analog switch is controlled by the signal from terminal A, B, or C. Switches S1, S2, and S3 in the analog switch are simultaneously switched. When the control signal is "L," S1, S2, and S3 are set to Z_0, X_0, and Y_0, respectively. When the control signal is "H", S1, S2, and S3 are set to Z_1, X_1, and Y_1, respectively.

When the P-P AUTO functions, voltages at the ends of A/B TRIG control RV2957 become the +Vp and the -Vp. With this, the variable range of RV2957 can correspond to the amplitude of the trigger signal, and an easy setting of the trigger level is performed.

When the P-P AUTO does not function, voltages at the ends of RV2957 become the +V (+2 V approximately) and the -V (-2 V approximately). These voltages are produced in the circuit ⟨11⟩. That is, the voltage of 12 V is divided by R2969 and R2970 to obtain the voltage of +2 V. The voltage of +2 V is supplied to voltage follower IC2954(1/2) so that the +V (+2 V) is obtained. Then, the +V is supplied to IC2954(2/2) so that -V (-2 V) is obtained.

DLY POS control RV2956 is a variable resistor having multiple functions and the five kinds of value (CURSOR (Δ, REF, REF/Δ), the DLY POS, and the CHR SEL) can be set. RV2956 controls the setting values since the rotation angles corresponding to each setting value are stored in the microcomputer.

The output range of IC2951 is ±2 V. The output signal of IC2951, the A/B TRIG voltage, the SWEEP VAR voltage, and the H POS voltage are supplied to analog switch IC2952. When the $\overline{\text{INH 1}}$ signal is "L," the microcomputer selects IC2952. IC2952 is switched by the signal from terminal A, or B. The output signal of IC2952 is fed out to the microcomputer via COMPARATOR IC2008 in the circuit ⟨12⟩.

For detailed description of IC2008, see the circuit ⟨12⟩.

Table 6-2 TRIGGER SELECTOR 1

CONTROL SIGNAL	SELECTED TRIGGER SOURCE				
	CH1	CH2	CH3	CH4	ALT
A SCE SEL1	H	L	H	L	H
A SCE SEL2	H	H	L	L	H
A SCE SEL3	L	L	L	L	H

Table 6-3 TRIGGER SELECTOR 2

CONTROL SIGNAL		SELECTED TRIGGER SOURCE				
		CH1	CH2	CH3	CH4	TV-H
A	B SCE SEL1	H	L	H	L	H
B	B SCE SEL2	H	H	L	L	H
C	$\overline{TV}$	H	H	H	H	L

Note: To select the TV-H mode, A TRIG COUPLING IC905 should be in TV-V or TV-H mode and both A CPL SEL2 and A CPL SEL3 should be "H."

Table 6-4 A TRIG COUPLING

	DC	AC	LF REJ	HF REJ	LINE	TV-V	TV-H
A CPL SEL1	L	H	L	L	H	L	H
A CPL SEL2	L	L	H	L	L	H	H
A CPL SEL3	L	L	L	H	H	H	H
IC905	X_0	X_1	X_2	X_4	X_5	X_6	X_7
IC1103a	X_1	X_1	X_1	X_1	X_1	X_1	X_0
K906	#1	#1	#1	#7	#7	#7	#7

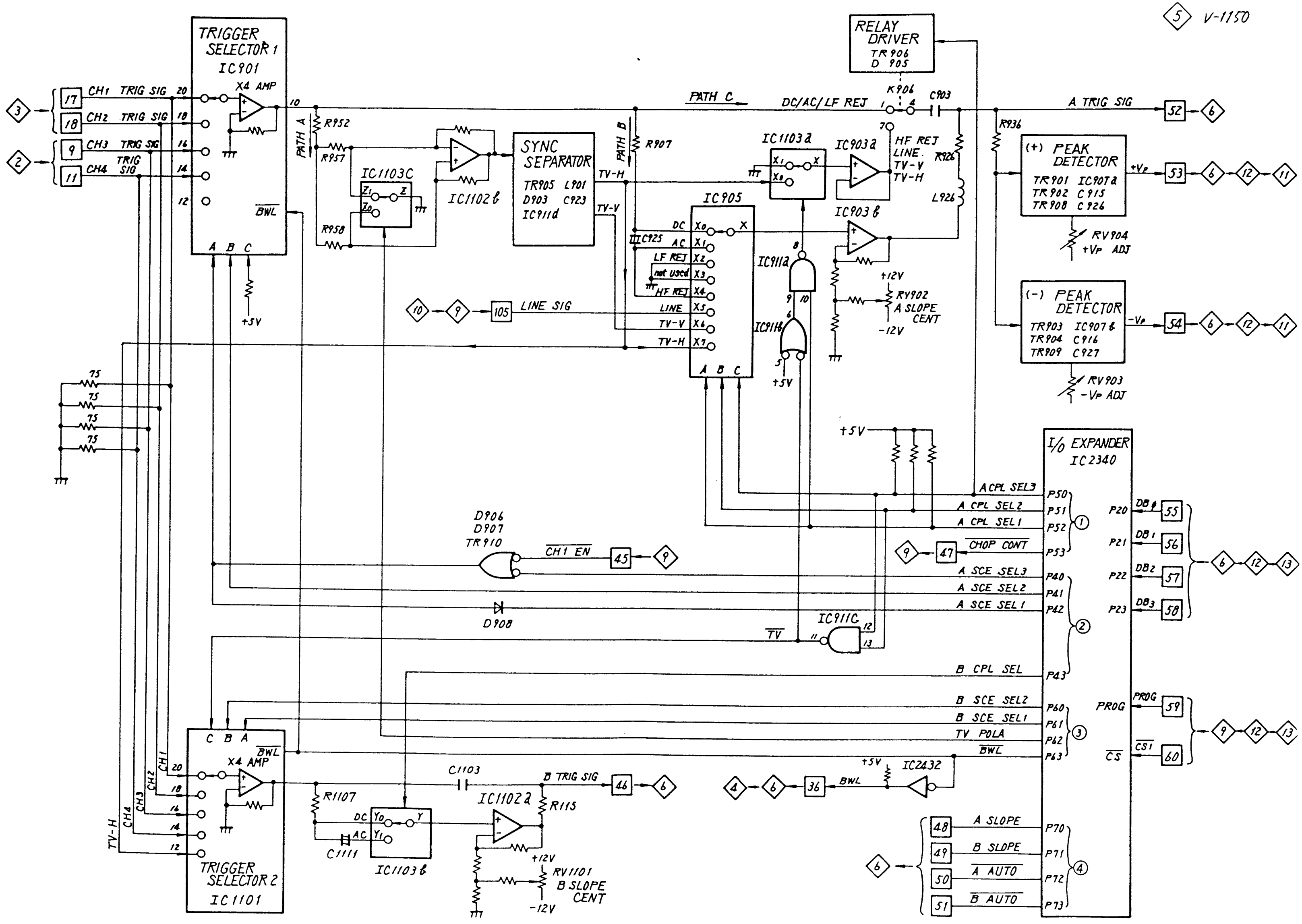

TRIGGER SELECTOR 1
IC901
X4 AMP
CH1 TRIG SIG
CH2 TRIG SIG
CH3 TRIG SIG
CH4 TRIG SIG
BWL
PATH A
PATH B
PATH C
R952
R957
R958
IC1103C
IC1102b
SYNC SEPARATOR
TR905 L901
D903 C923
IC911d
TV-H
TV-V
R907
IC905
DC
AC
LF REJ
not used
HF REJ
LINE
LINE SIG
C925
IC1103a
IC903a
IC903b
IC911a
IC911b
RELAY DRIVER
TR906
D905
K906
DC/AC/LF REJ
HF REJ
C903
A TRIG SIG
R936
R926
L926
(+) PEAK DETECTOR
TR901 IC907a
TR902 C915
TR908 C926
+Vp
RV904
+Vp ADJ
(−) PEAK DETECTOR
TR903 IC907b
TR904 C916
TR909 C927
−Vp
RV903
−Vp ADJ
RV902
A SLOPE CENT
+12V
−12V
+5V
75
I/O EXPANDER
IC2340
A CPL SEL3
A CPL SEL2
A CPL SEL1
CHOP CONT
A SCE SEL3
A SCE SEL2
A SCE SEL1
B CPL SEL
B SCE SEL2
B SCE SEL1
TV POLA
BWL
DB0
DB1
DB2
DB3
PROG
CS
CS1
D906
D907
TR910
CH1 EN
D908
IC911C
TV
IC2432
TRIGGER SELECTOR 2
IC1101
TV-H
C1103
B TRIG SIG
R1107
R115
IC1102a
IC1103b
C1111
RV1101
B SLOPE CENT
A SLOPE
B SLOPE
A AUTO
B AUTO

Fig. 6-6

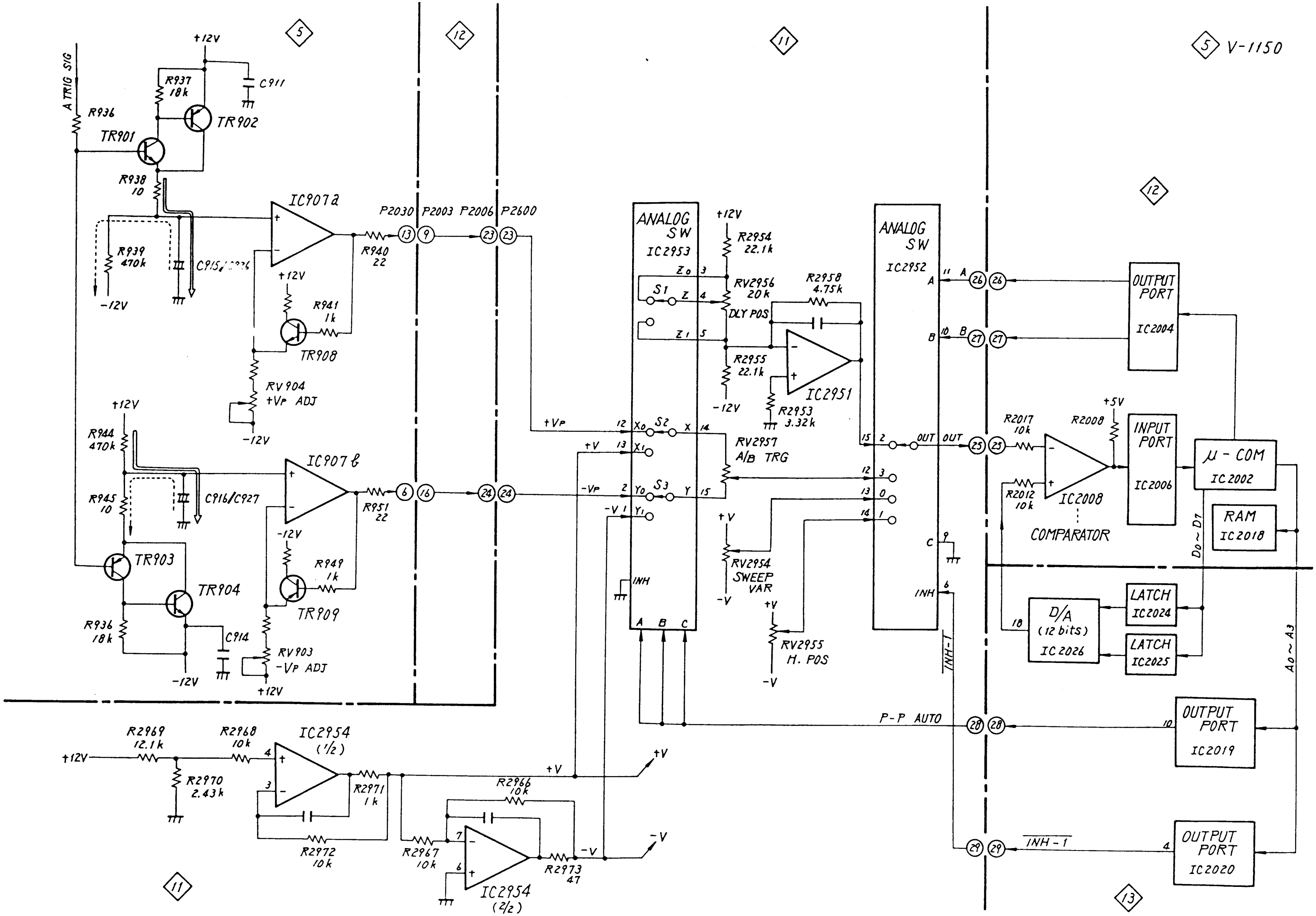

V-1150
A TRIG SIG
R936
TR901
TR902
R937 18k
C911
+12V
R938 10
R939 470k
-12V
IC907a
R940 22
R941 1k
TR908
RV904 +VP ADJ
P2030
P2003
P2006
P2600
+12V
R944 470k
R945 10
C916/C927
IC907b
R951 22
R949 1k
TR909
TR903
TR904
R936 18k
C914
RV903 -VP ADJ
+VP
-VP
ANALOG SW
IC2953
S1
S2
S3
INH
R2954 22.1k
RV2956 20k
DLY POS
R2958 4.75k
R2955 22.1k
IC2951
R2953 3.32k
RV2957 A/B TRG
RV2954 SWEEP VAR
RV2955 H. POS
ANALOG SW
IC2952
OUT
INH
INH-T
OUTPUT PORT
IC2004
R2017 10k
R2008
+5V
R2012 10k
IC2008
COMPARATOR
INPUT PORT
IC2006
μ-COM
IC2002
RAM
IC2018
D0~D7
D/A (12 bits)
IC2026
LATCH
IC2024
LATCH
IC2025
A0~A3
P-P AUTO
OUTPUT PORT
IC2019
INH-1
OUTPUT PORT
IC2020
R2969 12.1k
R2968 10k
R2970 2.43k
IC2954 (1/2)
R2971 1k
R2972 10k
R2966 10k
R2967 10k
IC2954 (2/2)
R2973 47
+V
-V

Fig. 6-7

◇6 SWEEP GATE & HOLDOFF (PEF-676)

Fig. 6-8 shows a detailed block diagram of this circuit.

A SWEEP (For A SWEEP timing chart, see Fig. 6-9.)

NORM mode

When the $\overline{\text{A AUTO}}$ from [50] is "H" in the NORM mode, IC1006 output becomes "L," and the output from IC1201a is decided by the input of pin 12. In other words, output from pin 3 of IC1 is not fed out to IC1201a.

The A SWEEP signal in the NORM mode is passed as indicated by ⇒ .

(1) When the holdoff period comes to almost the end, the voltage of HOLD OFF signal (pin4 of IC1) from ◇7 starts to decrease, IC1 detects the low level, that is the end level of hold off period, and the output from pin 2 of IC1 is changed to "L." Thus, the mode of input to terminal S of FF IC2 becomes "L," the holdoff setting is released.

(2) The output $\overline{Q}$ is changed from "L" (not-triggering level) to "H" (triggering level) by the trigger pulse supplied to T .

As a result, the triggering starts in the A SWP GEN circuit of ◇7. (Sawtooth wave is generated.)

(3) When the sawtooth wave passed through TR1352 of the circuit of ◇7 comes to the maximum level, the voltage of pin 4 of IC1 starts to rise, and IC1 detects the HIGH level (the maximum triggering level.) The resultant output from pin 2 of IC1 is changed from "L" to "H", which allows FF IC2 to establish set mode. The mode of output $\overline{Q}$ from IC2 is converted from "H" to "L", which inhibits triggering.

(4) Then, the sawtooth wave is reset at the level of sweep starting point.

(5) On the other hand, C_H (holdoff capacitor) selected by analog switch IC1358 is charged to high level by TR1352 during the sweep period.

(6) When the sawtooth wave is reset at the level of sweep starting point, C_H starts to be discharged by TR1361 and becomes the mode of (1) described above in the time corresponding to the capacitance of C_H.

AUTO mode

When the AUTO mode is selected, the trigger sweep or the free running sweep is automatically selected. The trigger sweep signal is passed as indicated by ═══> (same as the main signal of NORM mode).
The free running sweep signal is as indicated by ------>, in other words, the free running sweep signal from IC1 is directly passed to IC1201a not via IC2.

The trigger sweep signal or free running sweep signal is selected by the AUTO GATE output status.

(1) In the AUTO mode, output from IC1006 becomes open since the A AUTO from [50] is "L."

(2) In case the given trigger pulse is not applied, the output $\overline{Q}$ from FF IC2 is held "L," AUTO GATE output is "H."

Note:
The output from IC1201a is detected by input of pin 13 since input of pin 12 of IC1201a is "L". In this time, D1004 becomes off since AUTO GATE output is "H".

(3) When holdoff is completed, the mode of output from pin 3 of IC1 is changed from "L" to "H" and D1003 becomes off. Then the mode of input to pin 13 of IC1201a is also changed from "L" to "H."

As a result, the triggering starts in the A SWP GEN circuit of ◇7◇.

(4) After that, the same operations are followed as those of the NORM mode.

(5) In case the given trigger pulse is applied, the mode of output $\overline{Q}$ of FF IC2 is changed from "L" to "H," and the AUTO GATE output becomes "L."

(6) Then, the free running sweep signal passed from pin 3 of IC1 to pin 13 of IC1201a is shut out, and the trigger sweep starts in the AUTO mode as same as in the NORM mode.

SINGLE mode

(1) Then SINGLE RESET pulse produced when the [SGL] key is pressed is passed to holdoff line through the microcmomputer.

(2) Then, the mode of output of pin 2 of IC1 is changed from "H" to "L," and cancels the holdoff, and allows FF IC2 to be in the standby mode for triggering pulse.

(3) When the triggering pulse enters FF IC2, the A SWP GEN starts sweeping. After the sweeping is completed, the holdoff circuit is clamped at H level by TR1360. Consequently, the sweeping is inhibited.

(4) Since the holdoff mode is designed not to automatically cancelled, the SGL key is required to be pressed again to enable next sweep to activate. (The next sweep enable mode is called "ready status.")

The SGL indicator is kept illuminated during items (1) to (4).

The READY indicator lights when the SINGLE RESET pulse is produced; turns off after sweeping.

Fig. 6-10 shows the simplified circuit description.

B SWEEP (For B SWEEP timing chart, see Fig. 6-11.)

A AUTO mode (B STARTS AFTER DELAY)

(1) The B SWEEP GATE generator inhibits sweeping (IC4 is in the set mode) when the A SWEEP GATE starts sweeping.

Note: (1) corresponds to the holdoff state of A SWP.

(2) Negative delay trigger pulse is applied to pin 4 of IC3 by delay comparator the specified delay time after the A SWEEP GATE generator starts sweeping.

(3) Thus, the output from pin 2 is changed from "H" to "L", which allows IC4 to release the set mode. On the other hand, since the $\overline{\text{B AUTO}}$ signal mode is "L", TR2 is set to ON, pin 3 output whose polarity is reverse to pin 2's of IC3 is supplied to terminal R of IC4.

(4) Consequently, in the A AUTO mode, IC4 simultaneously establishes the reset mode when IC4 releases the set mode. Then, Q output is changed from "H" to "L" while $\overline{Q}$ output is changed from "L" to "H," and the B SWEEP GEN sweeps.

(5) After the B SWEEP GEN completes sweeping, positive sweep end pulse (B END) enters pin 4 of IC3, and pin 2 output of IC3 is changed from "L" to "H." Then, IC4 comes to be in the set mode, and the B SWEEP GEN inhibits sweeping.

NORM mode (B TRIGGERABLE AFTER DELAY)

In the NORM mode, TR2 becomes off since the $\overline{\text{B AUTO}}$ is "H," and the signal route from pin 3 of IC3 to terminal R of IC4 becomes off (open.)
Consequently, terminal R of IC4 is always set to "L."
The operations in the NORM mode is as shown below.

(1) Same as item (1) of the AUTO mode operations.

(2) Same as item (2) of the AUTO mode operations.

(3) When the delay trigger pulse is applied to pin 4 of IC3, pin 2 output is changed from "H" to "L," which allows IC4 to release the set mode.

(4) As a result, IC4 establishes the sweep enable mode.

Note:

B sweep will stop when the A sweep is completed. When the B trigger pulse is not produced in the interval from the time after delay to the end of A sweep, B sweep sawtooth wave is not generated.

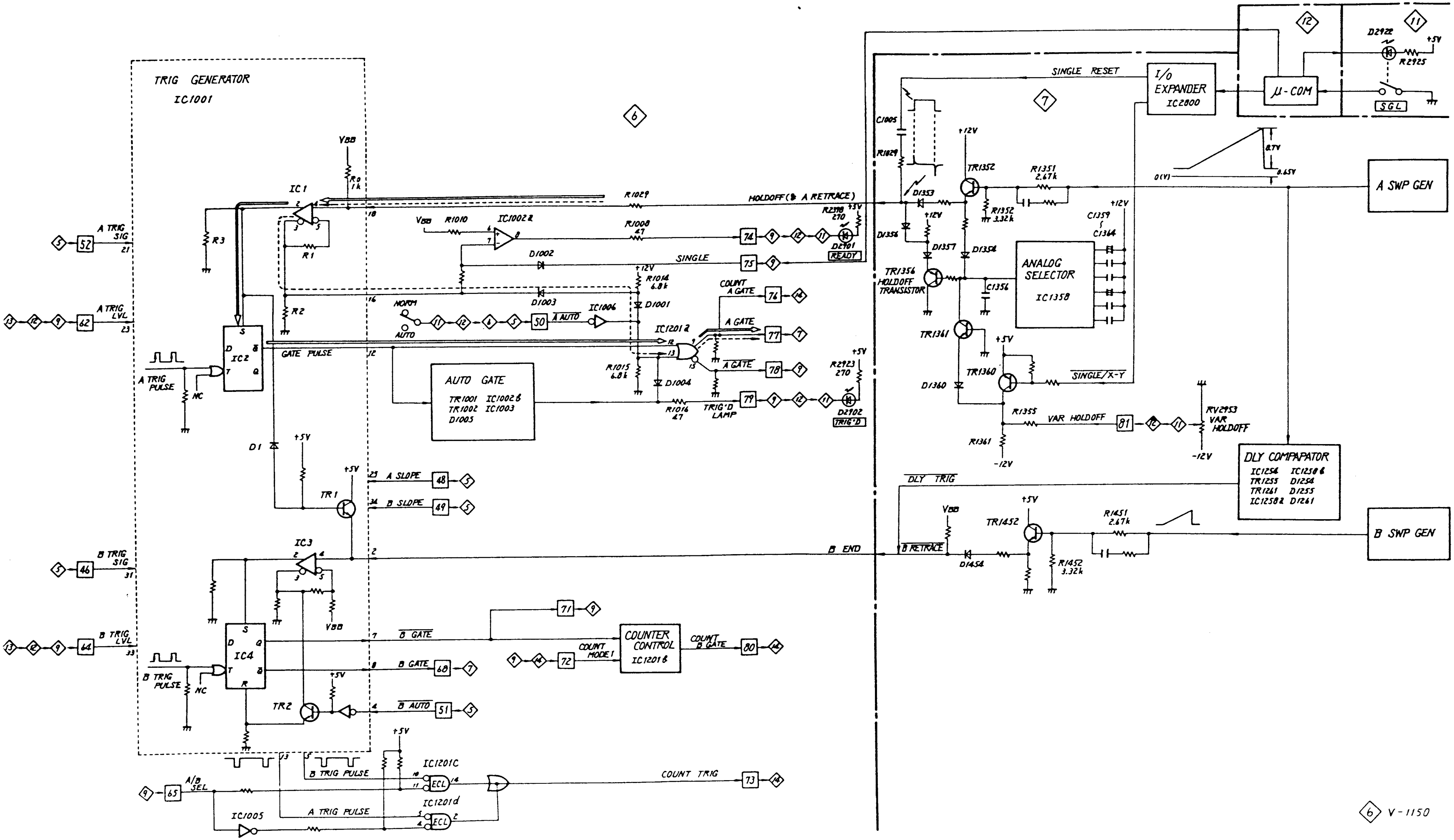

TRIG GENERATOR
IC1001
A TRIG SIG
A TRIG LVL
A TRIG PULSE
B TRIG SIG
B TRIG LVL
B TRIG PULSE
GATE PULSE
AUTO GATE
TR1001 IC1002b
TR1002 IC1003
D1005
HOLDOFF (B A RETRACE)
SINGLE
COUNT A GATE
A GATE
TRIG'D LAMP
READY
TRIG'D
SINGLE RESET
I/O EXPANDER
IC2800
μ-COM
SGL
ANALOG SELECTOR
IC1358
TR1356 HOLDOFF TRANSISTOR
SINGLE/X-Y
VAR HOLDOFF
RV2953 VAR HOLDOFF
A SWP GEN
DLY COMPARATOR
IC1256 IC1258b
TR1255 D1254
TR1261 D1255
IC1258a D1261
DLY TRIG
B END
B RETRACE
B SWP GEN
A SLOPE
B SLOPE
B GATE
COUNTER CONTROL
IC1201b
COUNT MODE 1
COUNT B GATE
B AUTO
A AUTO
NORM
AUTO
B TRIG PULSE
A TRIG PULSE
A/B SEL
COUNT TRIG
V-1150

Fig.6-8

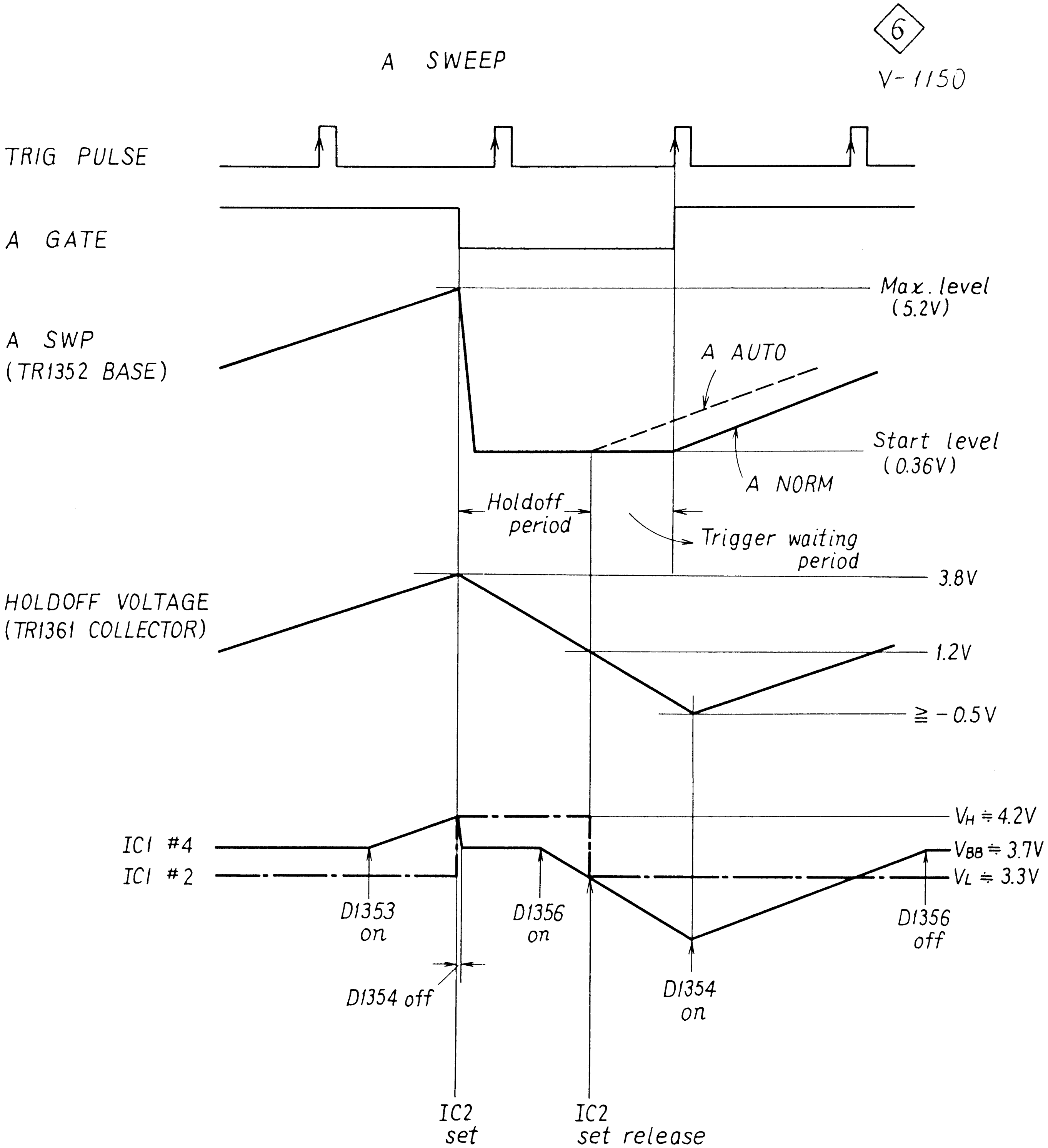

6
V-1150
A SWEEP
TRIG PULSE
A GATE
A SWP
(TR1352 BASE)
Max. level
(5.2V)
A AUTO
Start level
(0.36V)
A NORM
Holdoff period
Trigger waiting period
HOLDOFF VOLTAGE
(TR1361 COLLECTOR)
3.8V
1.2V
≧ -0.5V
IC1 #4
IC1 #2
VH ≑ 4.2V
VBB ≑ 3.7V
VL ≑ 3.3V
D1353 on
D1356 on
D1356 off
D1354 off
D1354 on
IC2 set
IC2 set release

Fig. 6-9

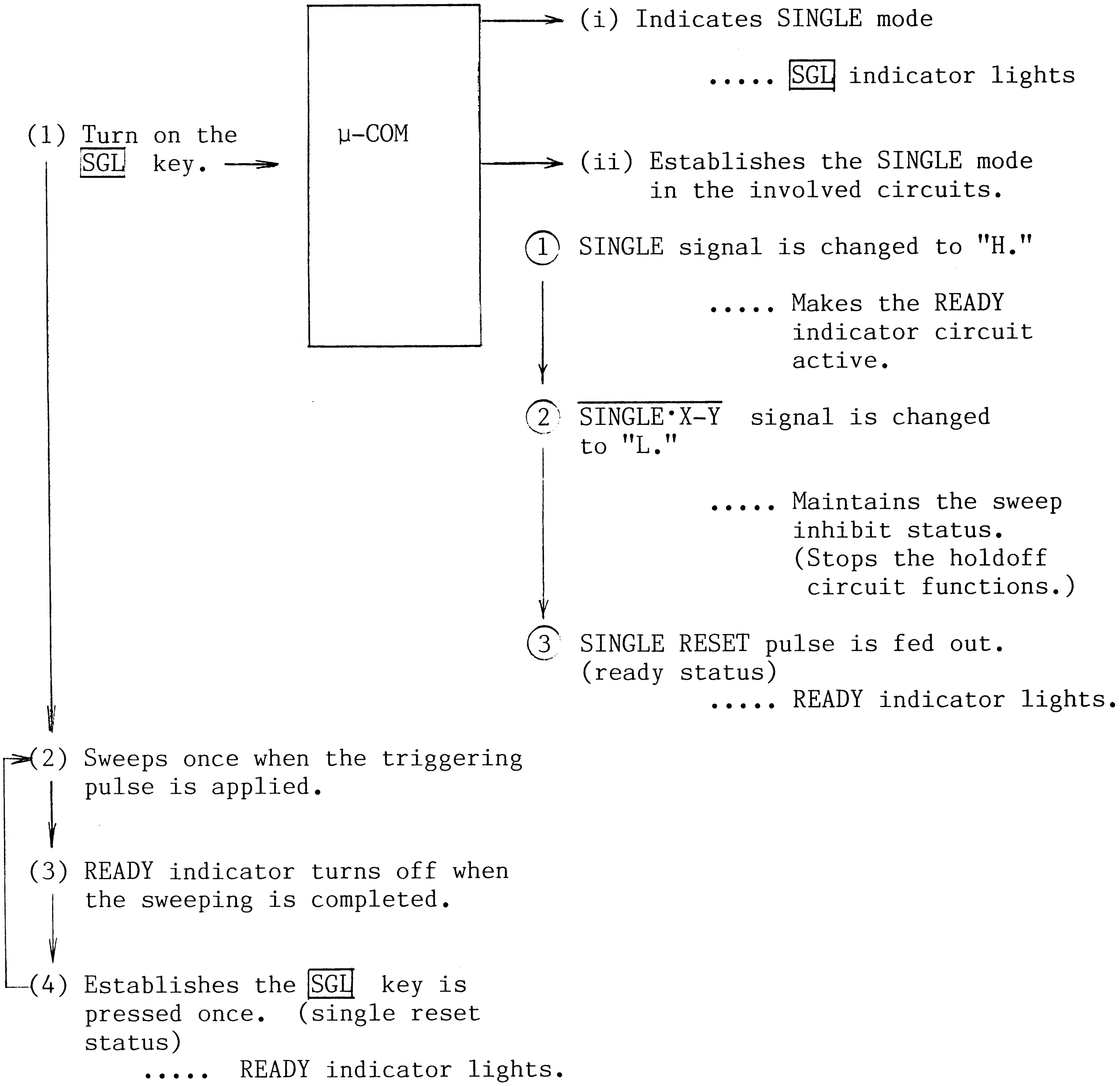

(1) Turn on the SGL key.
μ-COM
(i) Indicates SINGLE mode
..... SGL indicator lights
(ii) Establishes the SINGLE mode in the involved circuits.
① SINGLE signal is changed to "H."
..... Makes the READY indicator circuit active.
② $\overline{\text{SINGLE·X-Y}}$ signal is changed to "L."
..... Maintains the sweep inhibit status. (Stops the holdoff circuit functions.)
③ SINGLE RESET pulse is fed out. (ready status)
..... READY indicator lights.
(2) Sweeps once when the triggering pulse is applied.
(3) READY indicator turns off when the sweeping is completed.
(4) Establishes the SGL key is pressed once. (single reset status)
..... READY indicator lights.

Fig. 6-10

B SWEEP

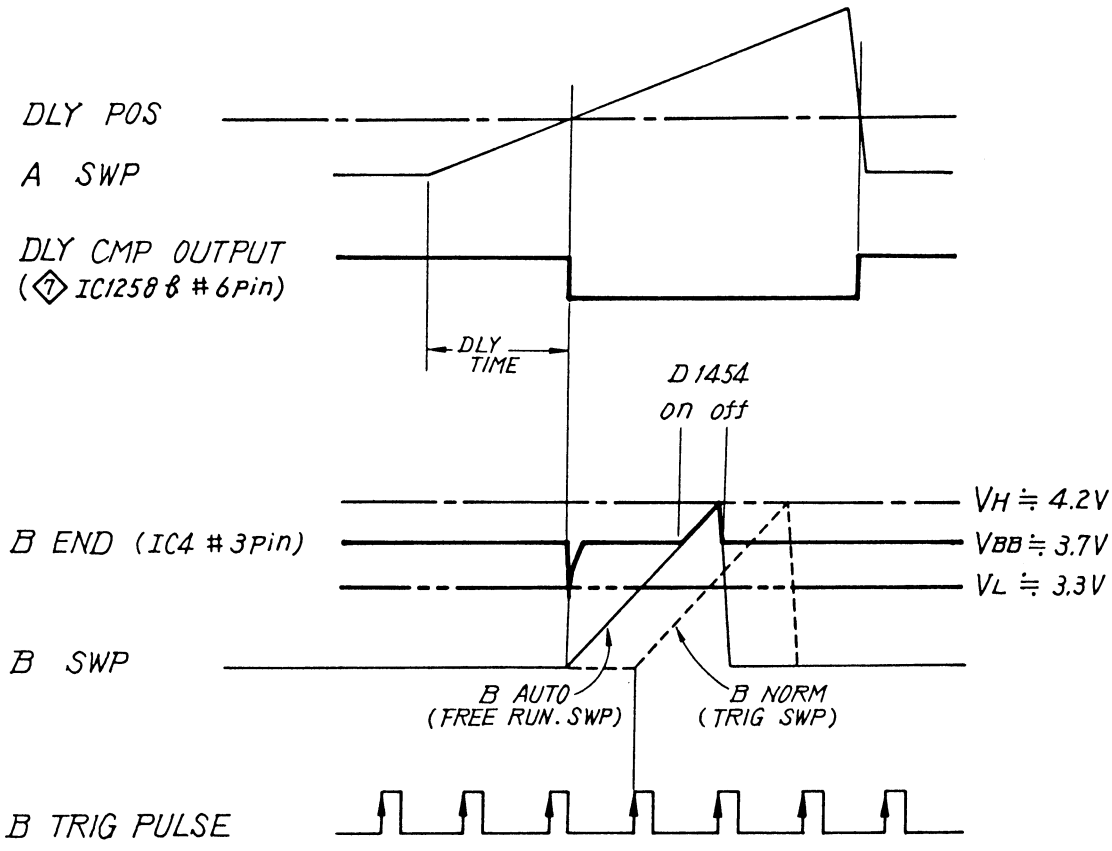


Fig. 6-11

⟨7⟩ A/B SWP GENERATOR (PEF-739)

Fig. 6-12 shows a detailed block diagram of this circuit. The operating principles of the A SWP GEN and the B SWP GEN are identical and the description is made only for the A SWP GEN.

The A SWP GEN is a Miller integrator circuit, by which a sawtooth wave with a good linearity can be obtained. When A GATE signal from [77] is supplied to SW(1), the A GATE and $\overline{\text{A GATE}}$ signals are fed out. When $\overline{\text{A GATE}}$ signal changes from "H" to "L," D1313, D1312, and D1311 become off, and the timing capacitor (C_T) consisting of CV1314, C1314, C1359 to C1361 is charged by a time constant determined by the setting position of the TIME/DIV switch. As a result, a sawtooth wave is fed from the A SWP GEN. When the $\overline{\text{A GATE}}$ signal changes from "L" to "H," D1312 and D1311 become on immediately, and the C_T is rapidly discharged. Thus, the sawtooth wave voltage drops to the voltage at starting point of a sweep operation (the voltage corresponding to the leftmost point of the x-axis on the CRT).

On the other hand, D1313 does not become on until the sawtooth wave voltage becomes the voltage at the starting point of the sweep operation. When D1313 becomes on, the input and the output signals of the A SWP GEN are short-circuited, and the output voltage of the A SWP GEN is kept constant (the voltage level at the starting point of a sweep operation).

The DLY POS signal from [82] is a DC voltage, which determines the delay trigger level, is fed to the DLY COMPARATOR via emitter follower TR1251. The output from the A SWP GEN is also fed to the DLY COMPARATOR. The output from the DLY COMPARATOR is shaped to a trigger pulse by the differentiating circuit (R1259 and C1259) and gate IC1258b, and fed to the circuit ⟨6⟩ as the $\overline{\text{DLY TRIG}}$ signal.

When the delay circuit does not operate, i.e. the horizontal display mode is A or the X-Y, DLY EN signal is set to "L," and IC1258b prevents the DLY TRIG from being fed from the DLY COMPARATOR. When the DISPLAY mode is "B," "ALT," or "INTEN," the comparator output is not cut off and the delay circuit activates.

The output from the A SWP GEN is converted from a voltage signal to a current signal by R1355, and is fed to the HORIZONTAL PREAMP via the SW(3). The same operation is applied to the relationship among the B SWP GEN, R1435, and the SW(4).

$\overline{\text{A DSP}}$ from [93] controls SW(3) and $\overline{\text{B DSP}}$ from [94] controls SW(4).
When the $\overline{\text{A DSP}}$ is "L," A SWP GEN output is fed out to the HORIZONTAL PREAMP; when the $\overline{\text{B DSP}}$ is "L," B SWP GEN output is fed out to the PREAMP.
The status of the $\overline{\text{A DSP}}$ and $\overline{\text{B DSP}}$ signals are selected by the horizontal display mode.

There are five modes in the horizontal display as shown below.

(1) A : Only the A sweep is displayed. This mode is established when the [A] switch is pressed.

(2) B : Only the B sweep is displayed. This mode is established when the [B] switch is pressed.

(3) INTEN : Only the A sweep whose delayed zone is intensified is displayed. This mode is established when the [A] and the [ALT] switches are simultaneously pressed.

(4) ALT : Both the B sweep and the A sweep whose delayed zones are intensified are displayed. In this mode, the A sweep whose delayed zone is intensified is displayed once and the B sweep is displayed twice. This mode is established when the [ALT] switch is pressed.

(5) X-Y : No signal for the A sweep and the B sweep is fed. This mode is established when the [X-Y] switch is pressed.

Table 6-5 shows the relationship of the horizontal display mode and the control signal.

The HORIZONTAL PREAMP converts the the sweep signal from a single-ended signal to a paraphase signal, adding a H POS (DC voltage for horizontal position) to the sweep signal.

The sweep circuit operation is described below. (See Fig. 6-13.)

A pulse, of which duty differs according to the time ratio of 1:2:5, is supplied from D/A circuit IC2023. According to the voltage value "H" or "L" of the pulse, CURRENT SWITCH S4 is switched. When S4 is on, the current I_2 flows into the INTEGRATOR. The DC voltage V_1 corresponding to the duty of the output pulse of D/A circuit IC2023 is supplied from the INTEGRATOR. Since analog switch S3 is switched according to the setting of the TIME/DIV switch, V_2 is also switched. The V_2 is converted into the I_2 through R2099 in the V/I CONVERTER (2) R2099.

V_0 of V/I CONVERTER (2) is kept constant when the A SWP VAR control is set to "CAL." When A SWP VAR control is rotated, V_0 changes.

RV1325 (A 10 ms/DIV), RV1326 (DLY 9 DIV) and RV1327 (A 10 μs/DIV) vary the absolute value of the current source of the SWP GEN (sweep generator), to change the tilt of the sweep.
Therefore the performance ununiformity of the C_T (timing capacitor) is corrected in any range.
The output V_1 of the INTEGRATOR is converted into the timing current I_1 through the V/I CONVERTER (1). The I_1 is selectable to x1, x10, or x100 by analog switch S2 in IC1331.

The value of the timing capacitor is switched to 1, $1/10^2$, $1/10^4$, or $1/10^6$ by analog switch S1.

Consequently, a sawtooth wave corresponding to the setting of the TIME/DIV switch is supplied from the SWP GEN.

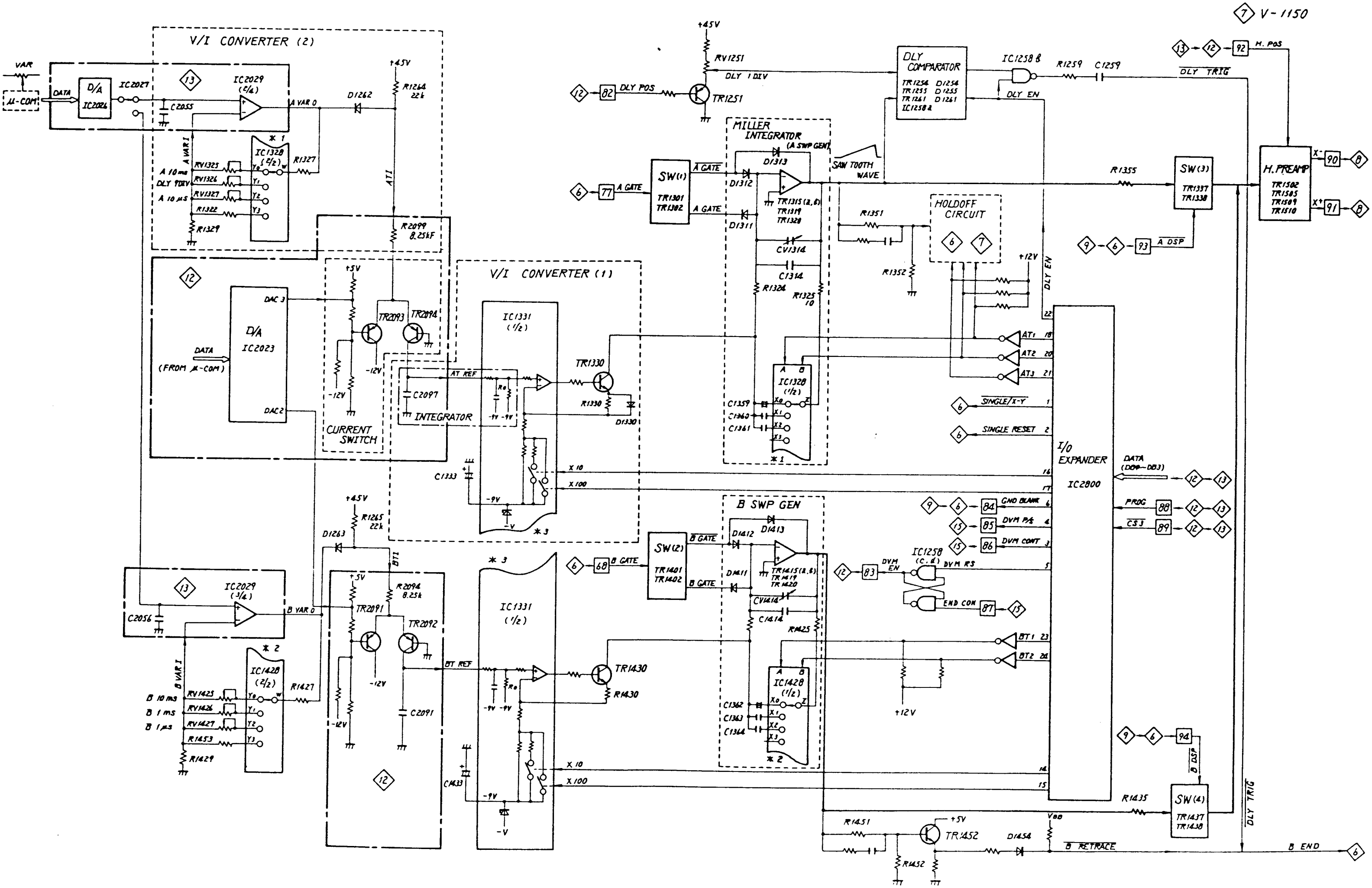

V-1150
V/I CONVERTER (2)
V/I CONVERTER (1)
CURRENT SWITCH
INTEGRATOR
MILLER INTEGRATOR
B SWP GEN
DLY COMPARATOR
HOLDOFF CIRCUIT
I/O EXPANDER IC2800
H. PREAMP
SAW TOOTH WAVE
DLY TRIG
B END

Fig. 6-12

7 V-1150

Table 6-5

Display modes / Control signals	A	INTEN	ALT	B	X-Y
H MODE1 (DB0)	L	L	L	H	H
H MODE2 (DB1)	L	L	H	L	H
$\overline{\text{ALT}\cdot\text{INTEN}}$	H	L	L	H	H
$\overline{\text{X-Y}}$	H	H	H	H	L
DLY EN	L	H	H	H	L

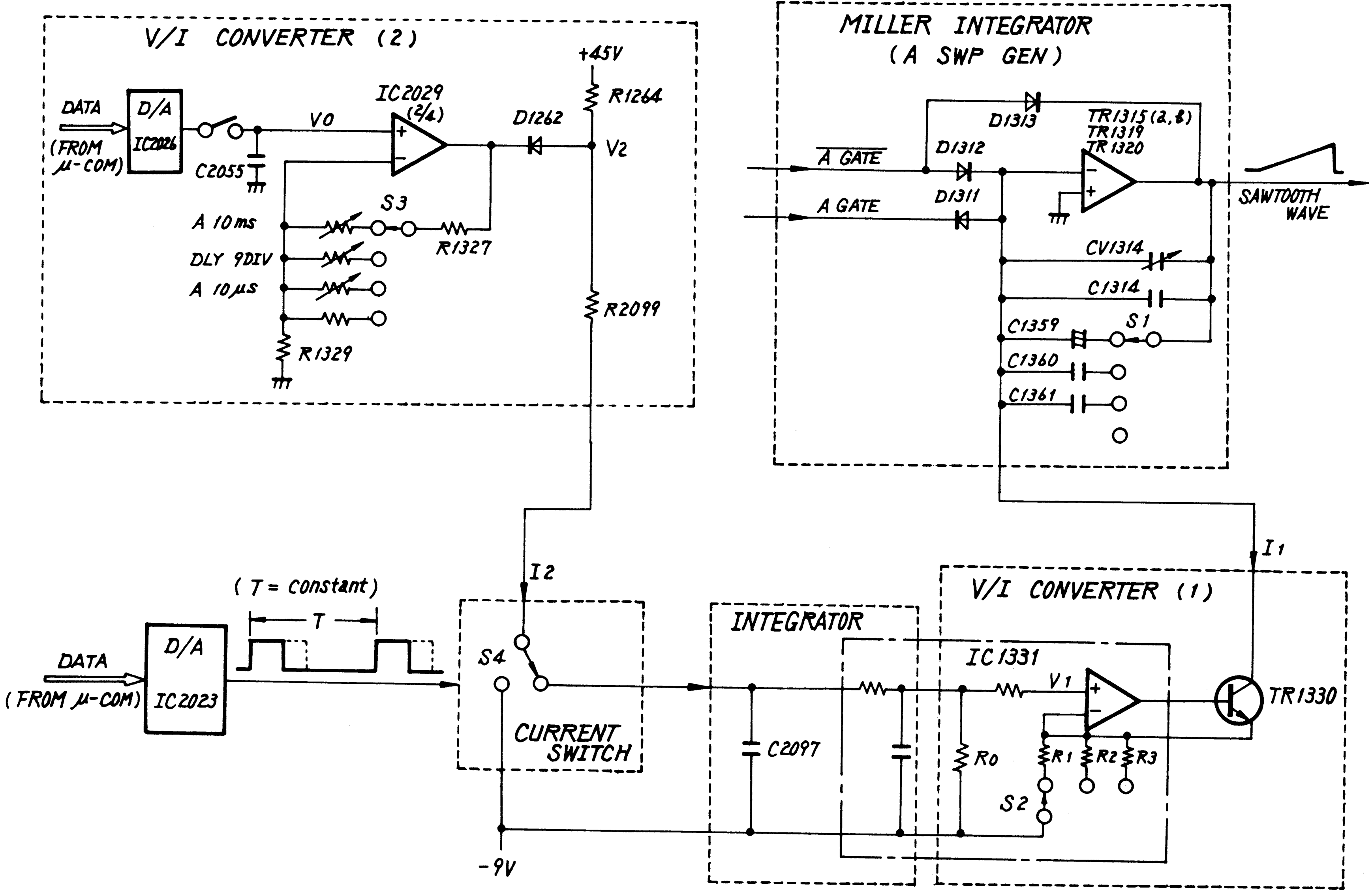

V/I CONVERTER (2)
DATA
(FROM μ-COM)
D/A
IC2026
C2055
V0
IC2029 (2/4)
D1262
+45V
R1264
V2
S3
A 10ms
DLY 9DIV
A 10μs
R1327
R1329
R2099
MILLER INTEGRATOR
(A SWP GEN)
D1313
TR1315(2,8)
TR1319
TR1320
A GATE
D1312
A GATE
D1311
SAWTOOTH WAVE
CV1314
C1314
C1359
S1
C1360
C1361
I1
I2
(T = constant)
T
DATA
(FROM μ-COM)
D/A
IC2023
S4
CURRENT SWITCH
-9V
INTEGRATOR
C2097
V/I CONVERTER (1)
IC1331
V1
R0
R1
R2
R3
S2
TR1330

Fig.6-13

8 HORIZONTAL OUTPUT AMP (PEF-740)

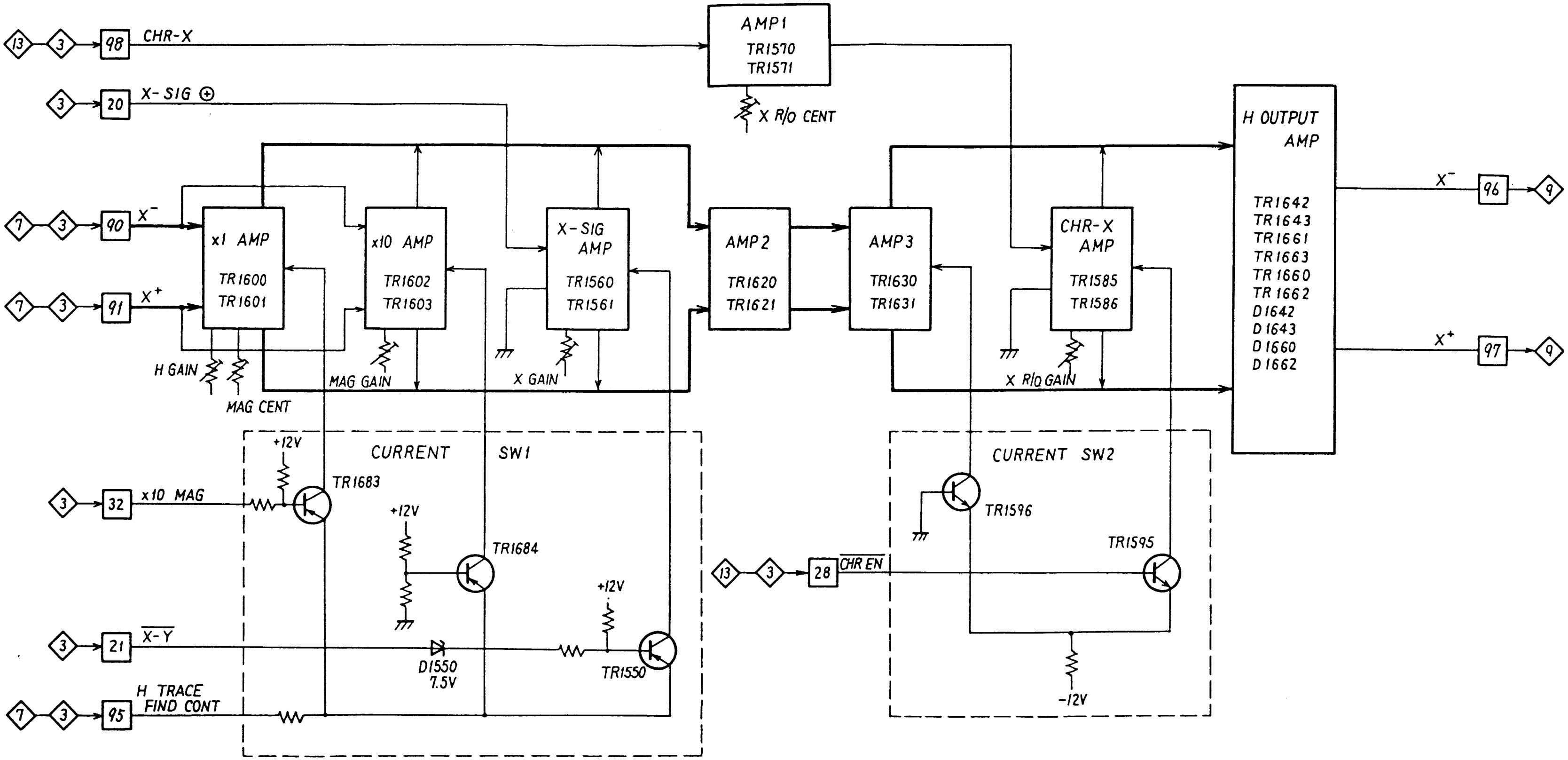
This circuit switches the horizontal amplifiers. The horizontal amplifiers can be switched to the X1, the X10, the X-SIG, or the CHR-X amplifier.

Fig. 6-14 shows a detailed block diagram of this circuit.
The sweep signals from [90] and [91] are supplied to the X1 AMP and X10 AMP. The X-SIG from [20] is supplied to the X-SIG AMP. One of the three amplifiers is selected by the CURRENT SW1, and the output from the selected amplifier is supplied to the AMP 3 via the AMP 2.
On the other hand, the CHR-X signal from [98] is supplied to the CHR-X AMP via the AMP 1. The output from the AMP 3 or the output from the CHR-X AMP is selected by the CURRENT SW2, and is supplied to the H. OUTPUT AMP. The output from the H. OUTPUT AMP is applied to the X-plate of the CRT via [96] and [97] .

TR1571 compensates for loss of the temperature characteristics of V_{BE} of TR1570.
The X10 MAG signal is supplied from [32] , $\overline{\text{X-Y}}$ signal is supplied from [21] , and the H. TRACE FIND CONT signal is supplied from [95] as control signals for the CURRENT SW1. When the X10 MAG signal is "L" and the $\overline{\text{X-Y}}$ signal is "H," the X1 AMP is selected.
When the X10 MAG signal and the $\overline{\text{X-Y}}$ signal are "H," the X10 AMP is selected.
When the $\overline{\text{X-Y}}$ signal is "L," the X-SIG AMP is given priority over the X1 AMP and the X10 AMP.

The H. TRACE FIND CONT signal voltage is usually +45 V. The voltage of +45 V drops when the TRACE FINDER switch is pressed for the TRACE FIND function. As a result, the bias current of the horizontal amplifier (the X1 AMP, the X10 AMP, or the X-SIG AMP) decreases, and the maximum amplitude is limited to be displayed within the CRT screen.

The CURRENT SW2 is controlled by the $\overline{\text{CHR EN}}$ signal from [28] . When the $\overline{\text{CHR EN}}$ signal is "H," the AMP 3 is selected, and when it is "L," i.e. in the character display mode, the CHR-X AMP is selected.



13
3
98
CHR-X
AMP1
TR1570
TR1571
X R/O CENT
3
20
X-SIG ⊕
H OUTPUT
AMP
TR1642
TR1643
TR1661
TR1663
TR1660
TR1662
D1642
D1643
D1660
D1662
7
3
90
X⁻
7
3
91
X⁺
x1 AMP
TR1600
TR1601
x10 AMP
TR1602
TR1603
X-SIG
AMP
TR1560
TR1561
AMP2
TR1620
TR1621
AMP3
TR1630
TR1631
CHR-X
AMP
TR1585
TR1586
X⁻
96
9
X⁺
97
9
H GAIN
MAG CENT
MAG GAIN
X GAIN
X R/O GAIN
CURRENT SW1
+12V
TR1683
3
32
x10 MAG
+12V
TR1684
+12V
3
21
X-Y
D1550
7.5V
TR1550
7
3
95
H TRACE
FIND CONT
CURRENT SW2
TR1596
TR1595
13
3
28
CHR EN
-12V

Fig. 6-14

<9> Z-AXIS AMP & CRT CONTROL (PEF-738 2/3)

This circuit consists of the DISPLAY SEQUENCER, the DISPLAY CONTROLLER, the DYNAMIC FOCUS and the HIGH VOLTAGE CRT & Z-AXIS AMP. Fig. 6-15 is the block diagram .

(1) DISPLAY SEQUENCER (IC2341, IC1524, IC1522, IC1523)

In this circuit, the orders and combinations of the control signals for the selection of the vertical channel and the sweep mode are determined. The resultant control signals (CH1 EN through CH4 EN, A DSP and B DSP) are fed out from this circuit.

The data fed from the microcomputer to the output port IC2341 are fed out from each port of IC2341 by the control signals PROG and CS2 fed from the microcomputer.

The used ports are P40-P43, P50, P51 and P73. As for the output signals from the other ports, see the appropriate circuit description.

The output signals from P40, P41, P50 and P51 designate the addresses of ROM. These addresses are the upper addresses which designate the kinds of modes displayed on the CRT. Then the lower addresses are automatically designated, and the data and the lower addresses to be designated are read out from ROM.
The relationship of the lower addresses A10-A8 and A3-A0 and the data stored in the places is described below.
Let us consider the case that the CH1-CH4 ALT are designated. When the bit arrangement of the output of LATCH IC1523 is CH1 EN, the designated addresses A3-A0 are Q4-Q1 and the data memorized in the places of the addresses A3-A0 are read out from O3-O∅ by the input of the clock pulse. The read-out data are CH2 EN. The bit arrangement of the data is the address designated next. In the place of these addresses, the data of CH3 EN are memorized.
Thus, CH1 EN → CH2 EN → CH3 EN → CH4 EN → CH1 EN are repeated and the ALT mode is established. The clock pulse applied to LATCH IC1523 is the CH SW PULSE fed out from the DISPLAY CONTROLLER.
A10-A8 are related to the outputs of A DSP and B DSP and the operational sequence is same as above.
The output signals A DSP and B DSP of LATCH IC1522 are supplied to gate IC 1526 together with the A GATE and B GATE signals from <6> , and they are fed out to <12> as the DSP ST(display state) signal. This gate circuit consists of a logic circuit that the DSP ST signal becomes "H" when both of the A DSP and A GATE signals are "L" or when both of the B DSP and B GATE signals are "L". In other words, the DSP ST signal is "L" in the blanking period and "H" in the unblanking period regardless of the A sweep and the B sweep.

The output from P50 and P51 of OUTPUT PORT IC2341 are delivered as the X-Y control signal to DISPLAY CONTROLLER IC1521 via NAND GATE IC1525b. In the X-Y mode, P50 and P51 are "H" and X-Y is The P51 output and the Q1 output (B DSP) of LATCH IC1522 are fed out as the A/B SEP CONT signal to ⟨4⟩ via NAND GATE IC1525a.

(2) DISPLAY CONTROLLER (IC1521)

As shown in the block diagram, the eleven control signals are applied and the three signals CH SW PULSE, UNBLANK and FOCUS are supplied.
The CH SW PULSE is used as a clock pulse of LATCH IC1523.
An oscillator is built in IC1521.
The oscillator changes the repetition cycle of the CH SW PULSE to that of the chop frequency when the CHOP CONT signal is "L".
C1524 is a capacitor which determines the chop time constant.
The input signals A&B INTEN, ΔB INTEN and R/O (READ OUT) INTEN are the DC voltages for brightness, which are adjusted by the variable resistors on the front panel. Three brightness controls A&B INTEN, ΔB INTEN and READ OUT INTEN are provided. The A&B INTEN control adjusts the brightness of the entire waveform. The ΔB INTEN control adjusts the difference of the A sweep and the B sweep in the delay mode. The READ OUT INTEN control adjusts the brightness of characters. By the combination of the DC voltages, the CHR Z, CHR Z EN and GND BLK signals and the A GATE, B GATE and A DSP signals which determine the timing of the display, the UNBLANKING signal current and the FOCUS signal current are fed out to Z-AXIS AMP and DYNAMIC FOCUS CKT, respectively.

(3) HIGH VOLTAGE CRT & Z-AXIS AMP

(A) DC/DC CONVERTER

The oscillator consisting of TR1761 and T1701 oscillates sine waves of 4500 Vp-p and 1950 Vp-p, which are fed to the HV MULTIPLIER and the HALF WAVE RECTIFIER. In the HV RECTIFIER, the cathode voltage (-1900 V) is produced and in the HALF WAVE RECTIFIER, the 3rd anode voltage (+18 kV) is produced. The ERROR DETECTOR AMP is provided to maintain the output of the HALF WAVE RECTIFIER constant and +100 volts is used as the reference voltage. An output error is detected by the ERROR DETECTOR AMP through feedback resistor R1770 and controls the bias current delivered to the oscillator. Thus, the amplitude of the oscillator output is maintained constant and the HALF WAVE RECTIFIER output also becomes constant.

(B) Z-AXIS AMP

The unblanking signal fed from the DISPLAY CONTROLLER is fed to the Z-AXIS AMP through BUFFER TR1728 and LIMITER. The input to the Z-AXIS AMP is limited by LIMITER and the blanking level of the output is not saturated.
The DC component and the low frequency component of the Z-AXIS AMP are applied to G1 of the CRT via the DC RESTORER, while the AC component is applied to G1 via C1778. Another control signal is added to the unblanking signal fed to the Z-AXIS AMP.
When the sweep mode is ALT or INTEN, the $\overline{\text{ALT INTEN}}$ signal ("L") fed out from P73 of OUTPUT PORT IC2341 is fed to pin 9 of IC1526d. The $\overline{\text{B GATE}}$ signal is fed to pin 8. In case of the waveform display, the output signal (point ⓐ in Fig. 6-15) of the OR GATE becomes "H" only during the A sweep period and the unblanking signal is reduced. (The unblinking signal is the current signal whose flowing direction is positive when it flows from the emitter of TR1728.)
This operation serves to reduce the entire brightness of the modulated waveform for easy observation.

(c) CHOPPER/DC RESTORER

These circuits produce the voltage applied to G1 of the CRT. As for the sine wave voltage (approx. 300 Vp-p) applied from the OSC via R1755, the positive peak is limited to E_A by D1775 and the negative peak is limited to the output voltage E_Z of the Z-AXIS AMP by D1778. The chopped waveform having the envelope of the difference of the CRT bias E_A and the Z-AXIS AMP output E_Z is thus obtained at point Ⓟ.
The chopped waveform is fed to D1776 via C1777. The positive peak is clamped to the cathode supply -1900 V.
The negative peak is rectified by D1777 and C1778 so that the negative DC voltage is produced. As a result, the signal whose DC level is shifted to the negative side with respect to the cathode voltage is applied to G1. The waveform of the signal is same as that of the Z-AXIS AMP output.) The rapid changing component of E_Z is transmitted directly to G1 via C1778.

(4) DYNAMIC FOCUS CKT

The focus of the CRT is controlled by FOCUS RV1787 on the front panel. For the waveform display, the AUTO FOCUS circuit is provided to deliver the correction signal which assures an optimum focus even if the brightness varies. The DC current corresponding to the DC voltage A&B INTEN flows to TR1781 to attain the AUTO FOCUS function. Further, the difference of the brightness setting between the waveform display and the character display is detected by IC1521 and the output signal current FOCUS is amplified by the AMP 1.
During the character display period, the signal (pulse) corresponding to the brightness difference between the waveform display and the character display is superimposed on the AUTO

display and the character display is superimposed on the AUTO FOCUS correction voltage via C1785, and the focus voltage is thus obtained. The focus voltage is applied to focus electrode P1 of the CRT.

(5) TRACE ROTATION

The TRACE ROTATION circuit consisting of TR1700 and TR1701 rotates the waveform displayed on the CRT.
The rotating direction is controlled by changing the direction of the current flowing to the rotation coil. The rotating angle is controlled by changing the amount of the current.

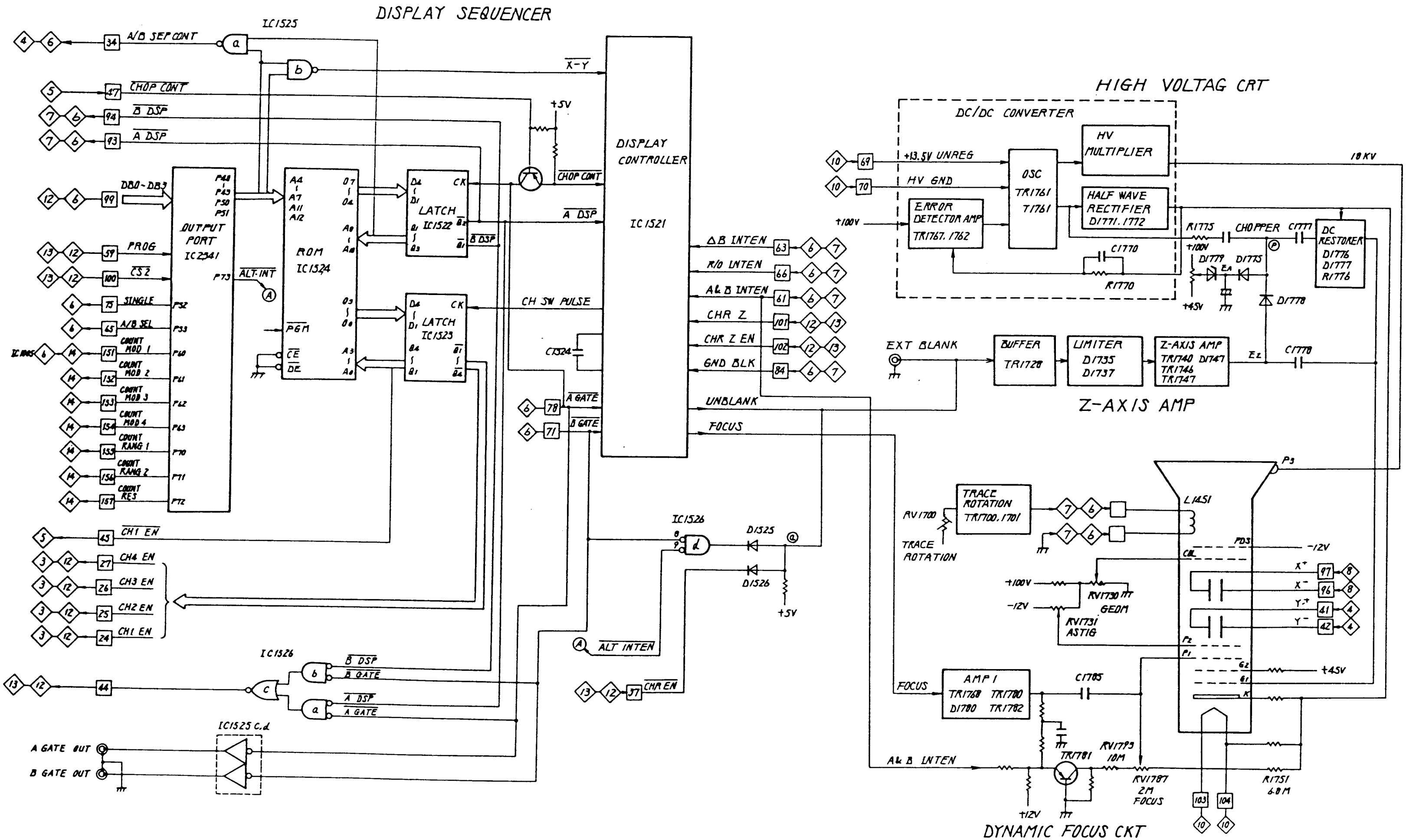

DISPLAY SEQUENCER
HIGH VOLTAG CRT
DC/DC CONVERTER
DISPLAY CONTROLLER
IC1521
OUTPUT PORT
IC2541
ROM
IC1524
LATCH
IC1522
IC1523
HV MULTIPLIER
OSC
TR1761
HALF WAVE RECTIFIER
D1771. 1772
ERROR DETECTOR AMP
TR1767. 1762
DC RESTORER
CHOPPER
BUFFER
LIMITER
Z-AXIS AMP
TRACE ROTATION
AMP 1
DYNAMIC FOCUS CKT
EXT BLANK
A GATE OUT
B GATE OUT
A/B SEP CONT
CHOP CONT
CH SW PULSE
UNBLANK
FOCUS
ALT INTEN
CHR EN
CH1 EN
CH4 EN
CH3 EN
CH2 EN
A&B INTEN
GEOM
ASTIG
10KV

Fig. 6-15

10 POWER SUPPLY

This circuit is a switching regulator. Fig. 6-16 is a simplified schematic diagram and Fig. 6-17 is a block diagram.

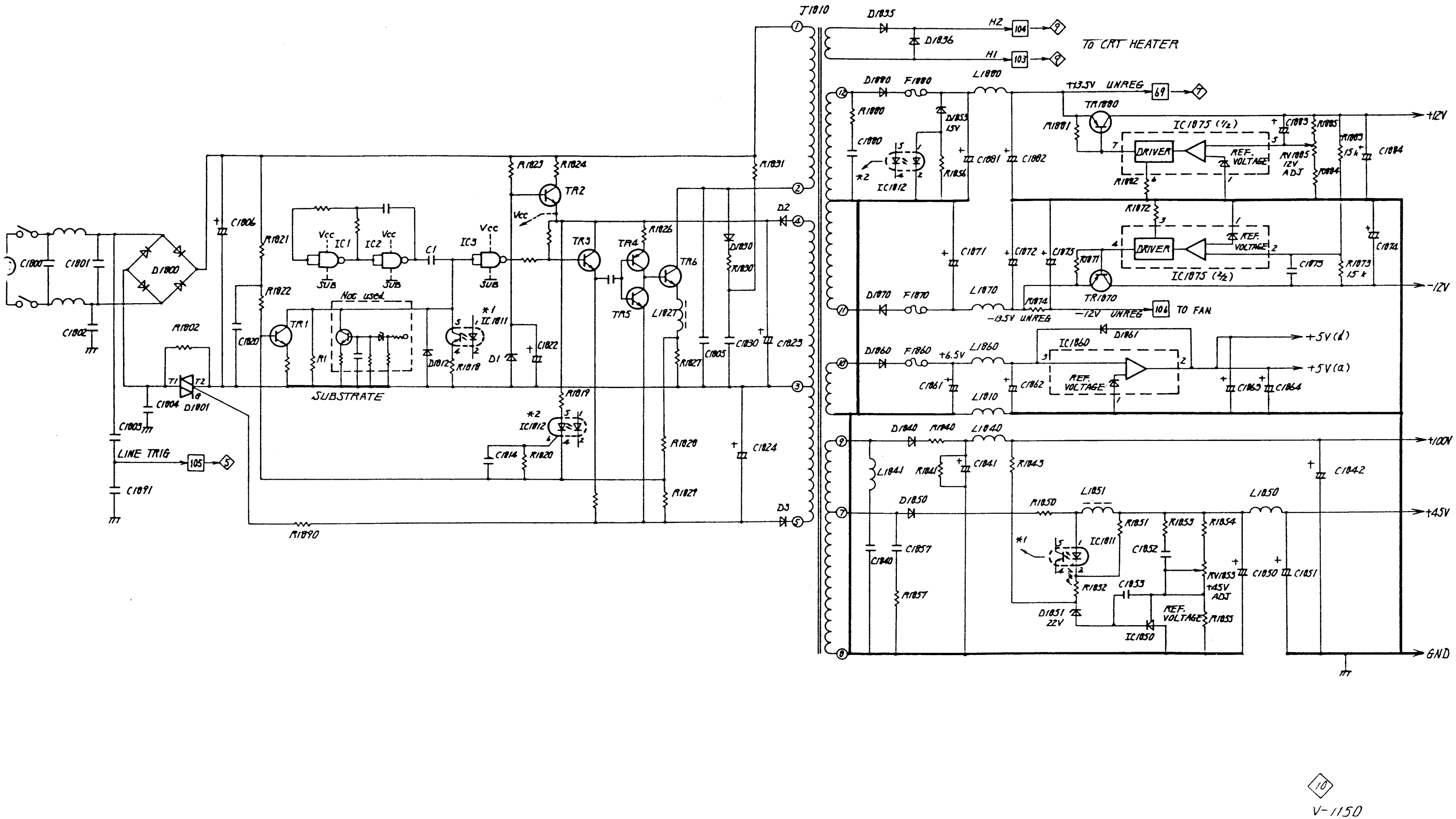
When the power switch is set on, the AC signal is applied to rectifying diode D1800 via the LINE FILTER and the charge current flows to C1806. D1801 is off immediately after the power is on and the charge current flows across R1802.

When the DC voltage at the plus side of C1806 gradually increases and reaches the voltage which allows the STARTER to be actuated, the 30 kHz OSC also starts to oscillate. As a result, the switching pulse is applied to switching transistor TR6 via the DRIVER, and a voltage is generated at the primary side (between ① and ②) of T1810. Thus, a voltage is also generated between ③ and ⑤ of the secondary side. The minus DC voltage generated by D3 and C1824 is applied to G (gate) of D1801, and D1801 becomes on. D1801 is a triac thyristor, which serves as an in-rush current protector.

When a voltage is produced between ③ and ⑤, a voltage is also produced between ③ and ④. When this voltage is applied to the rectifier circuit consisting of D2 and C1823, the plus DC voltage is fed out from the rectifier circuit to turn off STARTER TR2.
The output of the 30 kHz OSC is differentiated by C1 and impedance of TR1//R1//impedance of transistor of IC1811. The differentiated waveform is sliced at a constant level (logic level of IC3), resulting in the switching pulse. Consequently, when the current across TR1 or the current across transistor of IC1811 changes, the impedance of each transistor changes and the width of the switching pulse changes accordingly. When the width of the switching pulse changes, the output voltage also changes. Consequently, the output voltage can be controlled by the current flowing the both transistors described above.

When the TR3 base is "H," TR4 is off, TR5 is on, and TR6 is off. When TR3 base is "L," TR4 is on, TR5 is off and TR6 is on.
IC1811 is a photo-coupler and IC1812 is a photo-thyristor. With IC1811, IC1812 and the converter transformer, the primary side and the secondary side are insulated. The primary side and the secondary side are connected to the AC line and the chassis, respectively.
The converter transformer separates the main energy supply path, and IC1811 and IC1812 separate the feedback path. Photo-coupler IC1811 defects the secondary side output voltage and delivers the detected voltage to the primary side to control the width of the switching pulse so that the output voltage at the secondary side becomes constant. In other words, when the +45 V line voltage of the secondary side charges, the current flowing between ① and ② of IC1811 changes. The impedance between ④ and ⑤ changes accordingly, and the width of the switching pulse is changed.

Photo-thyristor IC1812 is an over-voltage protector. When the output of the secondary side is in over-voltage state, IC1812 actuates the LIMITER to make the width of the switching pulse narrow. The output voltage is thus controlled. Usually, the voltage obtained by dividing the output voltage of rectifier D1800 by R1821, R1822 and R1829 is applied to the TR1 base and IC1812 is off.
When the +13.5 V UNREG voltage of the secondary side is excessive, current flows between ① and ② of IC1812 and current also flows between ⑤ and ④. Thus, the current across R1829 increases and the base voltage of TR1 is raised. As a result, the current across TR1 increases and the impedance of TR1 decreases. The width of the switching pulse thus becomes narrow and the output voltage of the secondary side is limitted. C1814 is a filter. R1820 maintains the thyristors in IC1812 on as the gate bias of the thyristors.



V-1150

Fig. 6-16

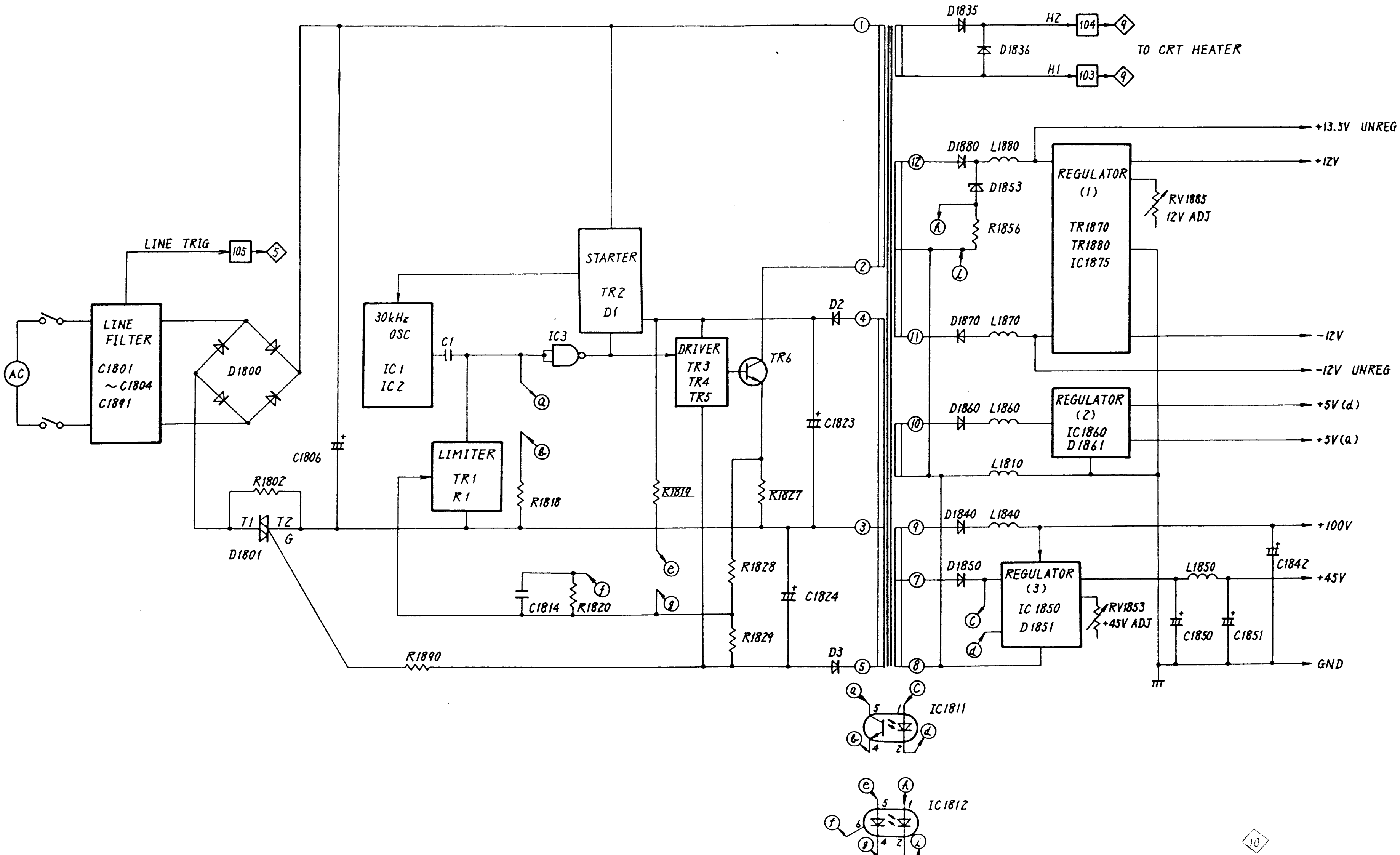


Fig. 6-17

10

V-150

⟨11⟩ PANEL INTERFACE

This circuit consists of

(1) The panel switch information circuit for delivering the information on the switches on the front panel to the microcomputer,

(2) the LED circuit for lighting the LEDs corresponding to the switches after the microcomputer has recognized the switch information, and

(3) the TRIG'D LED and the READY LED indicating the trigger state.

The above circuits are described below, using the block diagram Fig. 6-18.

(1) Panel switch information circuit

The switches on the front panel are arranged in an 8-row-by-5-column matrix and are always off. Each of the rows and the columns of the matrix are always kept high by pull-up resistors. When a switch is pressed, its contact is closed and the switching transistor connected to the column side of the switch becomes on. At this time, the column side and the row side of the switch become "L."

The information on the column is supplied with 5 lines (5 bits). On the other hand, the information on the row is shown with the 8-bit data, and fed to 8-TO-3 BITS ENCODER IC2905. The 8-bit data consists of seven bits showing each level of 1 to 7 rows and the least significant bit 0. The 8-TO-3 BITS ENCODER encodes the data and supplies them with 3 lines (3 bits).

The information on the 8th row (the uppermost row in Fig. 6-18). is independently delivered. The encoded 3-bit row data and the 5-bit column data are fed to INPUT PORT 2 IC2007 in the circuit ⟨12⟩ as an 8-bit parallel data in total.
The information on the 8th row is fed to INPUT PORT 3 IC2005 in the circuit ⟨12⟩ .

(2) LED circuit

This circuit consists of the series input/parallel output 8-BIT SHIFT REGISTER X3 (IC2900 to IC2902 connected in series), the series input/parallel output 8-BIT-SHIFT REGISTER X2 (IC2903 and IC2904 connected in series), and LEDs connected to the output pins of the 8-BIT-SHIFT REGISTERs.
When a switch is pressed, the corresponding LED is lit.

The switch information is delivered from the microcomputer as a serial data ("H or "L") to pins A and B of IC2900 and IC2903. The 8-BIT-SHIFT REGISTER X3 and the 8-BIT-SHIFT REGISTER X2 are operated by clock pulses SHFTCK1 and SHFTCK2, respectively.

When a switch is pressed, the clock pulse is supplied to the shift register connected with the LED corresponding to the switch. When the shift register connected with the LED corresponding to the switch is IC2900, IC2901, or IC2902, the SHFTCK1 is supplied to pin CK, the data fed to pins A and B are shifted in sequence by a rising portion of the SHFCK1. When the number of the clock pulse reaches 24, the SHFTCK1 input is stopped, and pins Q_0 to Q_7 of IC2900 to IC2902 are kept at a level at this time. Then, the LED connected to output pins with "L" level is lit.

The level of pins are kept until the next switch is pressed and the clock pulse is supplied to pins.
As for the SHFTCK2, 16 pulses are supplied in sequence to light the LED in the same way as the SHFTCK1.

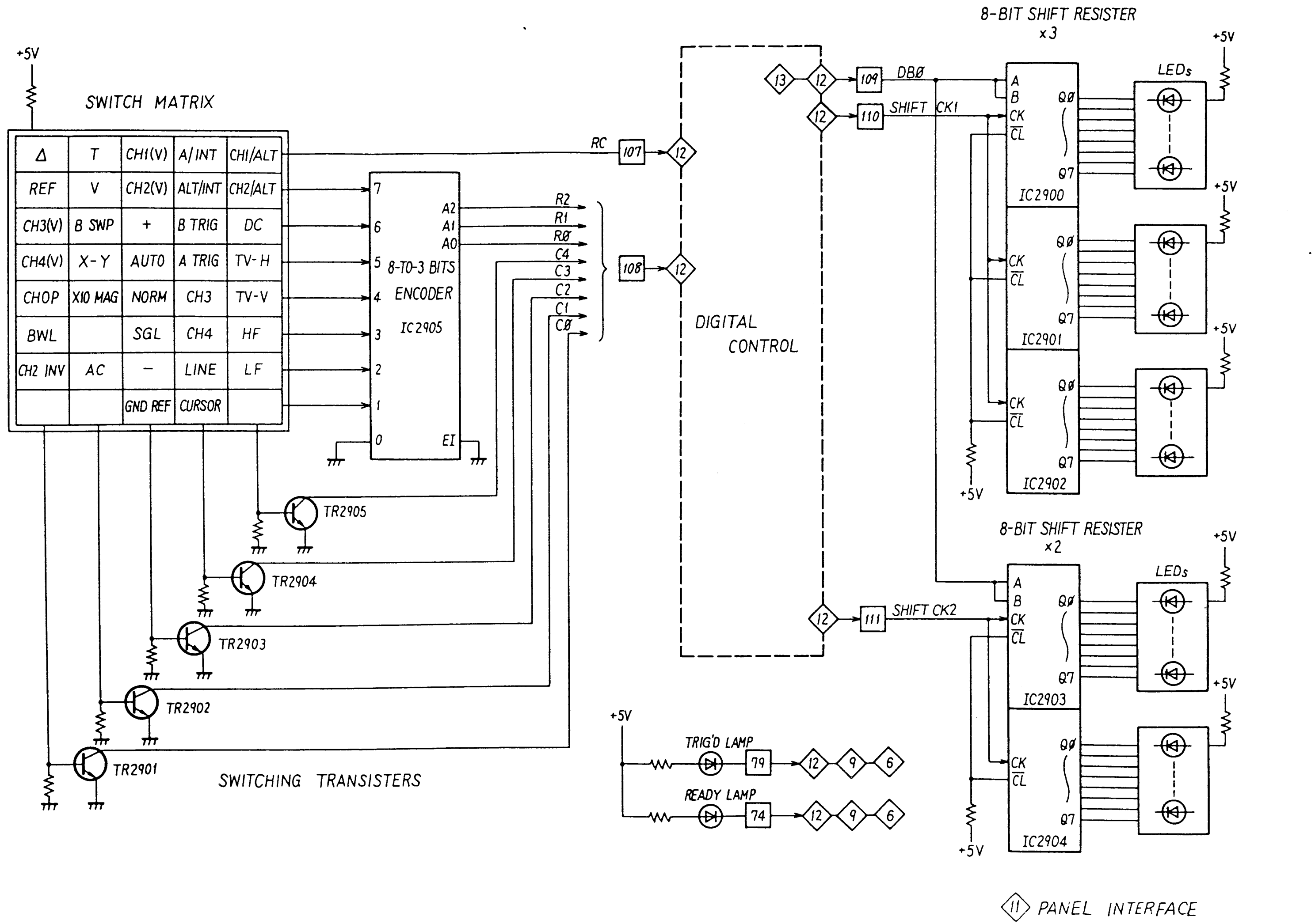

+5V
SWITCH MATRIX
Δ
T
CH1(V)
A/INT
CH1/ALT
REF
V
CH2(V)
ALT/INT
CH2/ALT
CH3(V)
B SWP
+
B TRIG
DC
CH4(V)
X-Y
AUTO
A TRIG
TV-H
CHOP
X10 MAG
NORM
CH3
TV-V
BWL
SGL
CH4
HF
CH2 INV
AC
−
LINE
LF
GND REF
CURSOR
8-TO-3 BITS ENCODER
IC2905
A2
A1
A0
EI
R2
R1
RØ
C4
C3
C2
C1
CØ
RC
107
108
TR2905
TR2904
TR2903
TR2902
TR2901
SWITCHING TRANSISTERS
DIGITAL CONTROL
13
12
109
110
111
DBØ
SHIFT CK1
SHIFT CK2
8-BIT SHIFT RESISTER x3
8-BIT SHIFT RESISTER x2
LEDs
A
B
CK
CL
QØ
Q7
IC2900
IC2901
IC2902
IC2903
IC2904
TRIG'D LAMP
READY LAMP
79
74
9
6
11
PANEL INTERFACE

Fig. 6-18

⟨12⟩ DIGITAL CONTROL (1) (PEF-745 1/2)

Figure 6-19 shows a detailed block diagram of this circuit. The voltages corresponding to the setting position of switches such as the INPUT COUPLING, the CAL/UNCAL, the VOLTS/DIV , and the TIME/DIV on the front panel are supplied to terminals X_0 to X_7 of ANALOG SWITCH 1 IC2001. One of the signals from the terminals is selected by the control signals from terminals A, B, and C, and is supplied to the minus side of COMPARATOR IC2008 in the following stage.
To the plus side, the voltage from terminal I OUT of D/A converter IC2026 in the circuit ⟨13⟩ is supplied via [118] . At this time, COMPARATOR IC2008 and D/A converter IC2026 function as an A/D converter by the control from the microcomputer. The inputs at the minus and the plus sides are compared and the resultant COMPARATOR output is supplied to microcomputer IC2002 via INPUT PORT 1 IC2006.

After having read the result, the microcomputer issues the next command to the D/A converter IC2026 in the circuit ⟨13⟩ , and supplies another voltage to the COMPARATOR from terminal I OUT of IC2026. By repeating the above comparisons many times, the microcomputer reads the voltage value from the minus side of the COMPARATOR, and recognizes the setting state of switches on the front panel.

IC2006, IC2007, and IC2005 are input ports, which latch input data, and supply them to the microcomputer by the control signal fed to their respective terminals 1. Microcomputer IC2002 is Z-80 or equivalent. IC2013 is an EP-ROM of 32 kbytes (256 kbits) and IC2018 is a RAM of 2 kbytes.
ADDRESS DECODER 1 IC2014 controls ADDRESS DECODER 2 IC2016, ADDRESS DECODER 3 IC2015, RAM1 IC2018, and RAM2 IC2113 in the circuit ⟨13⟩ .
ADDRESS DECODER 2 IC2016 and ADDRESS DECODER 3 control the input ports and the output ports, respectively.
The same IC is used for IC2014, IC2015, and IC2016. The ICs are controlled by the signal fed to their respective terminals A, B, and C, which are available only when G1 is "H," $\overline{G2A}$ is "L," and $\overline{G2B}$ is "L."
Terminals A, B, and C denote 2^0, 2^1, and 2^2 digits, respectively. The signals at C, B, and A denote 3-digit binary $(CBA)_2$. When $(CBA)_2$ is equal to $(000)_2$, $(001)_2$, and $(111)_2$, terminals Y_0, Y_1, and Y_7 are selected, respectively.
The "L" signal is supplied from the selected terminal. For example, let's consider the case that the data of INPUT PORT 1 IC2006 is delivered to the microcomputer.
Terminal $\overline{G2A}$ of IC2014 is "L," and the "H" signal and the "L" signal are supplied from the microcomputer to terminals G1 and $\overline{G2B}$, respectively.
Similarly, data (1,0,0) are delivered from the microcomputer to terminals C, B, A, respectively, and terminal Y_4 is selected. The "L" signal is supplied from Y_4 to $\overline{G2B}$'s of IC2015 and IC2016. The "L" signal is supplied to terminal $\overline{G2A}$ of IC2016 from terminal $\overline{RD}$ of the microcomputer.

The "H" signal is supplied to G1 of IC2016 from A_{11} of the micro-computer. The "L" signal is supplied to terminal G1 of IC2015 by IC2009(2/4). Consequently, ADDRESS DECODER 2 IC2016 is selected. Further, data (0,0,0) are delivered to terminals C, B, and A of IC2016 from the microcomputer, and the "L" signal is supplied from Y_0 of IC2016. Then, INPUT PORT 1 IC2006 is selected.
As a result, the data at the INPUT PORT is delivered to the micro-computer.

IC2003 is a clock pulse generator, and the clock pulses of 4 MHz, 2 MHz, and 1 MHz are generated. The 2 MHz clock pulse is used as a reference clock of the microcomuter. The 1 MHz clock pulse is supplied to the circuit ◇14 , and is used as a reference clock pulse for the counter circuit. The 1 MHz clock pulse is further counted down to 1 kHz in the circuit ◇14 , and is fed back to the circuit ◇12 via [129] . The 1 kHz clock pulse is supplied from J1606 via the BUFFER consisting of IC2010(1/4) and IC2010(2/4). To keep the output level at 0.5 V, adjust CAL ADJ control RV2001. The 4 MHz is used as a reference clock for D/A (1) IC2003. The D/A (1) is a D/A converter for modulating the pulse width. A periodical pulse which changes its duty in accordance with the start point of the B sweep is supplied from terminal DAC 1. This pulse is supplied to C-MOS IC2010(3/4), and the constant "H" and "L" levels are obtained.
z
Then, the pulse is supplied to the LPF, and the DC voltage propor-tional to the pulse duty is produced, and supplied from [82] as a DLY POS signal. The DLY POS signal (DC voltage) determines the voltage at the starting point of the B sweep.
A periodical pulse which changes its duty in accordance with the B sweep ratio (1:2:5) is supplied from terminal DAC 2 to the CURRENT SWITCH 1. When the pulse is "H," TR2091 becomes on and TR2092 becomes off. When the pulse is "L," TR2091 becomes off and TR2092 becomes on. By this pulse, the reference current BT I from [144] flows through C2091 in accordance with the pulse duty of the output from terminal DAC 2.
As a result, the DC voltage (average voltage) of the output pulse from terminal DAC 2 develops at both sides of C2091, and is supplied from [145] as a BT REF signal. The output from terminal DAC 3 is used for the A sweep, and the operation is same as that of terminal DAC 2.
A 500 kHz clock pulse is supplied to INTERRUPT GENERATOR IC2017 from pin 11 of D/A (1) IC2003. The output from IC2017 allows the microcomputer to perform several operations at regular periods.

The reset circuit and the memory backup circuit are described below by using Figure 6-20. As shown in Figure 6-20, the reset circuit consists of the RC circuit and the Schmitt trigger circuit. If the power is off, the potential at point (f) becomes zero volts. When the power is turned on at this time, the charging current ⇐(3)⇒ flows to C2010 via R2007 and the potential at point (f) rises gradually. When the potential reaches a certain value, the output of the Schmitt trigger circuit changes from "L" to "H." That is, terminal $\overline{RES}$ of the microcomputer is kept low in a certain period immediately after the power is turned on. The Schmitt trigger circuit is provided since an ideal exponential function waveform cannot be obtained at point (f).

If the potential at point (f) is observed in detail, it deviates faintly. The deviation makes a misleading judge of "H" or "L" near the threshold level of the digital circuit. Then, the Schmitt trigger circuit having a hysteresis characteristic is used.

If the power is frequently turned on and off, a quick discharge of C2010 is required. Diode D2005 is then provided to shorten the discharge time by allowing the discharging current to flow in the direction of arrow ⇒(4)⇒. To reset the oscilloscope manually, press the READOUT switch and the TRACE FINDER switch simultaneously. The potential at point (f) becomes "L," and the oscilloscope is reset. (This oscilloscope is not provided with an independent reset switch.) Even if the power is cut or the +5V(d) line voltage drops, the built-in memory backup circuit

(1) Supplies the voltage to terminal V_{cc} of RAM 1 IC2018 ((1) in Figure 6-20) to prevent the data in the RAM from being destroyed, and

(2) Sets terminal $\overline{CS}$ of RAM 1 IC2018 ((2) in Figure 6-20) to "H" to prevent the RAM from being selected (i.e. prevents the RAM from reading and writing the data.)

When the +5V(d) line voltage is normal, TR2003 is on, and the current flows in the direction of arrow ⇒(1)⇒. Then, the voltage of +5V is supplied to (1) , TR2001 becomes on, and the control signal from pin 10 of IC2014 is supplied to RAM 1 IC2018. As shown in figure 6-20, TR2001 can be regarded as a switch controlled by the voltage at point b . C2025 is charged by part of the current shown with 1 . On the other hand, TR2004 is on, the potential at point b is "L" and D2003 is on. Then, the potential at point (e) becomes "L," TR2002 becomes off, and the potential at point (f) becomes "H."

If the +5V(d) line voltage drops, the potential at point (a) drops, TR2004 becomes off, and the potential at point (b) becomes "H." Then, D2003 becomes off, the potential at point (e) becomes "H," and TR2002 becomes on. The potential at point (f) becomes "L," terminal $\overline{RES}$ of the microcomputer becomes "L."
<u>That is, when the +5V(d) line voltage drops, the microcomputer keeps the reset state</u>.
On the other hand, TR2001 becomes off since the potential at point (b) is "H," and TR2003 also becomes off. Then, the voltage (approximately 5V) at point (c) is supplied to points (1) and (2) .)
As shown above, the operations (1) and (2) of the memory backup circuit are performed.

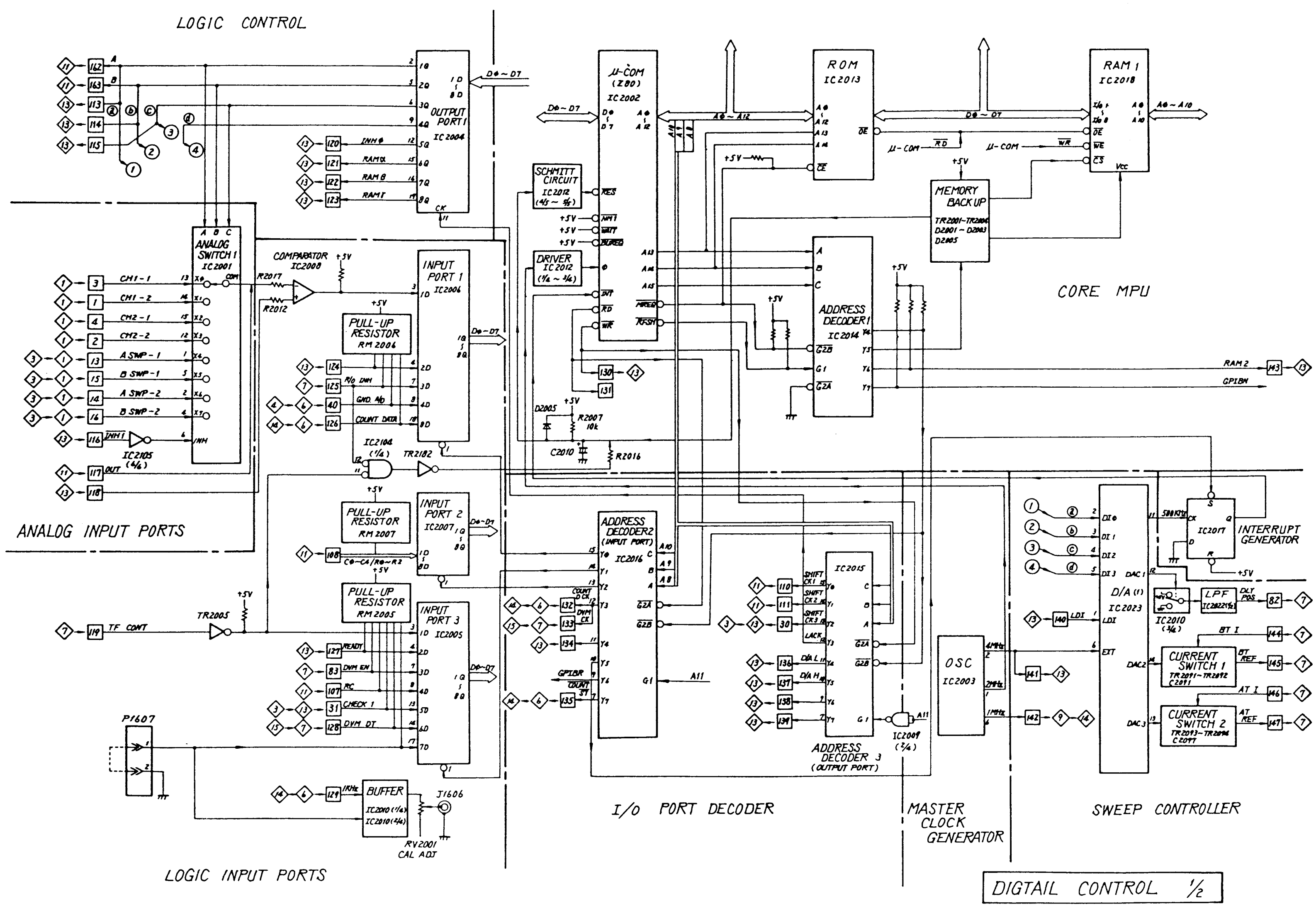

LOGIC CONTROL
OUTPUT PORT 1 IC2004
ANALOG SWITCH 1 IC2001
COMPARATOR IC2000
PULL-UP RESISTOR RM2006
INPUT PORT 1 IC2006
PULL-UP RESISTOR RM2007
INPUT PORT 2 IC2007
PULL-UP RESISTOR RM2005
INPUT PORT 3 IC2005
ANALOG INPUT PORTS
BUFFER
LOGIC INPUT PORTS
μ-COM (Z80) IC2002
SCHMITT CIRCUIT IC2012
DRIVER IC2012
ROM IC2013
RAM 1 IC2018
MEMORY BACK UP
ADDRESS DECODER 1 IC2014
CORE MPU
ADDRESS DECODER2 (INPUT PORT) IC2016
ADDRESS DECODER 3 (OUTPUT PORT) IC2015
I/O PORT DECODER
OSC IC2003
MASTER CLOCK GENERATOR
D/A IC2023
INTERRUPT GENERATOR
LPF
CURRENT SWITCH 1
CURRENT SWITCH 2
SWEEP CONTROLLER
DIGTAIL CONTROL 1/2

Fig. 6-19

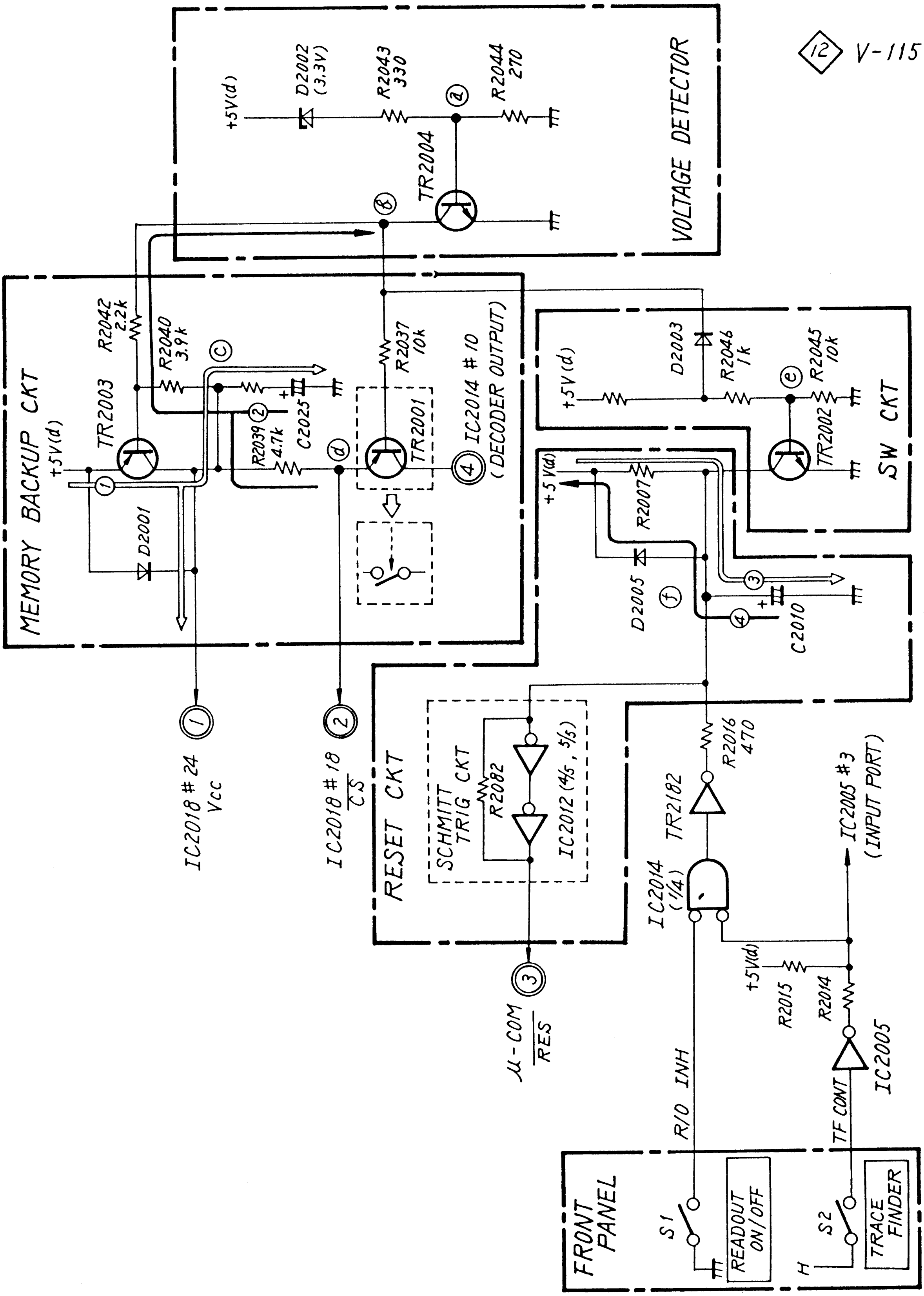

12 V-1150
VOLTAGE DETECTOR
+5V(d)
D2002 (3.3V)
R2043 330
R2044 270
TR2004
MEMORY BACKUP CKT
+5V(d)
TR2003
R2042 2.2k
R2040 3.9k
R2039 4.7k
C2025
D2001
R2037 10k
TR2001
IC2014 #10 (DECODER OUTPUT)
SW CKT
+5V(d)
D2003
R2046 1k
R2045 10k
TR2002
+5V(d)
R2007
D2005
C2010
RESET CKT
SCHMITT TRIG CKT
R2082
IC2012 (4/5, 5/5)
R2016 470
TR2182
IC2014 (1/4)
+5V(d)
R2015
R2014
IC2005
IC2005 #3 (INPUT PORT)
IC2018 #24 Vcc
IC2018 #18 CS
μ-COM RES
R/O INH
TF CONT
FRONT PANEL
S1
READOUT ON/OFF
S2
TRACE FINDER
H

Fig.6-20

⟨13⟩ DIGITAL CONTROL (2) (PEF-745 2/2)

OUTLINE

Fig. 6-21 is a detailed block diagram, which consists of two blocks.

Block (1) generates signals required for the character display and consists of:

i) The DISPLAY RAM and the DOT TIMING GENERATOR which produce "the dot signals constituting a character" from a character pattern,

ii) the DISPLAY TIMING CONTROLLER which controls the display rate, and

iii) the CLOCK CONTROLLER, the SCAN COUNTER, the VERTICAL CHARACTER DAC, the RASTER GENERATOR, and the CURSOR TIMING GENERATOR and the MODE SELECTOR which produce scanning lines for the display.

Block (2) controls circuits and consists of the READOUT CONTROL PORT, the LOGIC CONTROL, and the ANALOG CONTROL

DISPLAY RAM and DOT TIMING GENERATOR

RAM2 IC2113 is a RAM for display. BUS BUFFER IC2114 controls the following operations:

(1) In the writing mode: Supplies the character data from the ROM in the circuit ⟨12⟩ to the RAM2 via data bus (DO through D7).

(2) In the reading mode: Supplies the data in the RAM2 to the data bus via the BUS BUFFER.

(3) In the display mode: Supplies the data in the RAM2 to DATA SELECTOR IC2115 in the following stage since the data bus and the RAM2 are off.

DOT TIMING GENERATOR IC2127 generates a timing signal for the dot display. DATA SELECTOR IC2115 supplies "H" signals from terminal Y when a dot is displayed and "L" signals when a dot is not displayed.

When terminal Y of IC2115 becomes "H" with pins 2 and 5 of IC2127(1/2) at "H," the "L" signal is supplied from IC2127(1/2). Pin 2 of IC2127 (1/2) becomes "H" when one dot display is completed. (See Fig. 6-22 for details.) At this time, pin 5 of IC2127 (1/2) is "L" and becomes "H" when the inhibited period of dot display is completed. This period corresponds to the period that the output of IC2109(2/2), part of the DISPLAY TIMING CONTROLLER is "H." When the "L" signal is supplied from IC2127(1/2), SHIFT REGISTER IC2123 in the following stage is reset.

After that, the data from terminal A (with "H" level since it is connected to the voltage of +5 V) is shifted to terminals Q_0 to Q_7 of IC2123 at each rising portion of a clock pulse fed to terminal CK.
The CHR EN, the CHRZ, and the CHR EN Z signals are produced from output signals from the output terminals of IC2123. Operations of these signals are shown below, and Fig. 6-22 is the timing chart of the operations.

(1) CHR EN signal
- H: Changes the operation modes of the vertical and horizontal circuits from the waveform display mode to the character display mode.
- L: Changes the operation modes of the vertical and horizontal circuits from the character display mode to the waveform display mode.

Notes:
When the DISPLAY mode is set to ALT, the brightness difference is always generated between the "A" and "B" displays. In other words, the input to Z-AXIS AMP is changed by the brightness difference. However, the brightness difference is not allowed to occur in the character display. The difference in brightness is allowed to occur <u>only in</u> the <u>waveform</u> display. The brightness is controlled by the $\overline{\text{CHR EN}}$ and $\overline{\text{ALT}\cdot\text{INTEN}}$ signals.

(2) CHR Z signal
- H: Makes a dot bright.

(3) CHR EN Z signal
- H: Allows IC1521 in <9> to change the operation mode of the character display mode.

Note:
The Z-AXIS AMP is switched by the CHR Z EN signal to eliminate transient since the switching timing of the Z-AXIS AMP differs from that of the vertical or horizontal circuit.

DISPLAY TIMING CONTROLLER

This circuit sets the time intervals of the dot display equal regardless of of the position of the dots and makes more dots to be displayed in the blanking period than in the unblanking period. As a result, an easy-to-observe waveform is also obtained although the characters are displayed with the waveform.

A pulse having the frequency (F) proportional to the 1-line display rate is supplied to the F-V CONVERTER from terminal QB_1 of counter IC2122. The pulse width is constant, and its period is irregular. The F-V CONVERTER supplies the voltage (V) proportional to the frequency (F), and the following V-I CONVERTER controls ONE-SHOT MULTI IC2109(2/2).
When the output pulse from the ONE-SHOT MULTI is "H," a dot can be displayed. When it is "L," the dot display is inhibited. The output pulse is supplied to pin 5 of IC2127(1/2) mentioned above.

The DSP ST (display state) signal from 44 is "L" in the blanking period and "H" in the unblanking period.

CLOCK CONTROLLER and SCAN COUNTER

The SCAN COUNTER is controlled by the RAM2 signal, the outputs from the OUTPUT PORT 2, the SCAN COUNTER itself, and terminal $\overline{Y}$ of IC2115 so that the following operations (1) to (4) are performed. (The 4 MHz clock pulse is used as a clock pulse for the SCAN COUNTER.)

(1) The SCAN COUNTER is operated when characters are displayed.
(2) The SCAN COUNTER is stopped when waveforms are displayed.
(3) The SCAN COUNTER is stopped when one picture display is completed in the character display mode.
(4) The address in the RAM2 is specified when the character pattern data is supplied from the ROM to the RAM.

When one display is completed, the "L" signal is supplied to pin 13 of the GATE 1, the 4 MHz clock pulse does not pass the GATE 1, and the SCAN COUNTER stops. When characters are not displayed, the "H" signal is supplied to pin 9 of the GATE 1, and the clock pulse does not pass the GATE 1.
When the "L" signal is supplied to pin 3 of the GATE 2, the RAM signal passes the GATE 2. When the "H" signal is supplied, the output from terminal QC_1 of IC2121 passes the GATE 2.
When the character pattern data is written in the RAM2, the RAM2 signal passes the GATE 2, and designates the address for writing the character pattern data.

In the character display mode, the output from terminal QC_1 of IC2121 passes the GATE 2 and the SCAN COUNTER operates. However, the SCAN COUNTER stops when dots are made bright.
As shown above, the character scanning signal with a digital level is produced.

VERTICAL CHARACTER DAC, RASTER GENERATOR, CURSOR TIMING GENERATOR, and MODE SELECTOR

Eight lines are provided for the character display on a CRT screen. One line consists of 8 scanning lines. Seven lines are used for the character display, and the remaining one is used for the cursor display. However, the maximum number of lines which can be displayed at a time on the screen is four. (See Fig. 6-23.)
The D/A (2) and the D/A (3) designate the vertical position of dots constituting a character and the vertical scanning line position, respectively.
GATE 3 IC2127(2/2) is a gate for enabling the cursor display, and detects the 8th scanning line in one line. When the 8th scanning line is detected, the "L" signal is supplied form the GATE 3, and the "H" signal is supplied to terminal A of IC2107 via IC2009(4/4). When the ground reference line is detected, the cursor should be displayed.
The output from the D/A (5) designates the horizontal position of dots which are components of a character. IC2029(1/4) supplies the data for the vertical position of the cursor.

The ANALOG SWITCH (3) is controlled by the signals fed to terminals A and B, and
(1) switches the character display and the cursor display, and
(2) switches the vertical cursor and the horizonal cursor. (See Fig. 6-24.)

The output from terminal X of the ANALOG SWITCH 3 is a signal designating the horizontal position of the character (or the cursor). The output from terminal Y is a signal designating the vertical position.

ANALOG CONTROL

ANALOG SWITCH 2 IC2027 switches its output terminals with the signals fed to terminals A, B, and C.
In this circuit, the switching is performed in sequence so that hold capacitors C2050 to C2053 and C2055 to C2057 are regularly charged.

The outputs from terminals X_0 and X_1 of IC2027 are used in the trigger circuit ◇6 and the outputs from terminals X_5, X_6, and $_7$ are used in the sweep circuit ◇7 .
The voltages for the REF cursor (shown with an alternate long and short dash line) and for the Δ cursor (shown with a dotted line) are supplied from terminals X_2 and X_3, respectively.

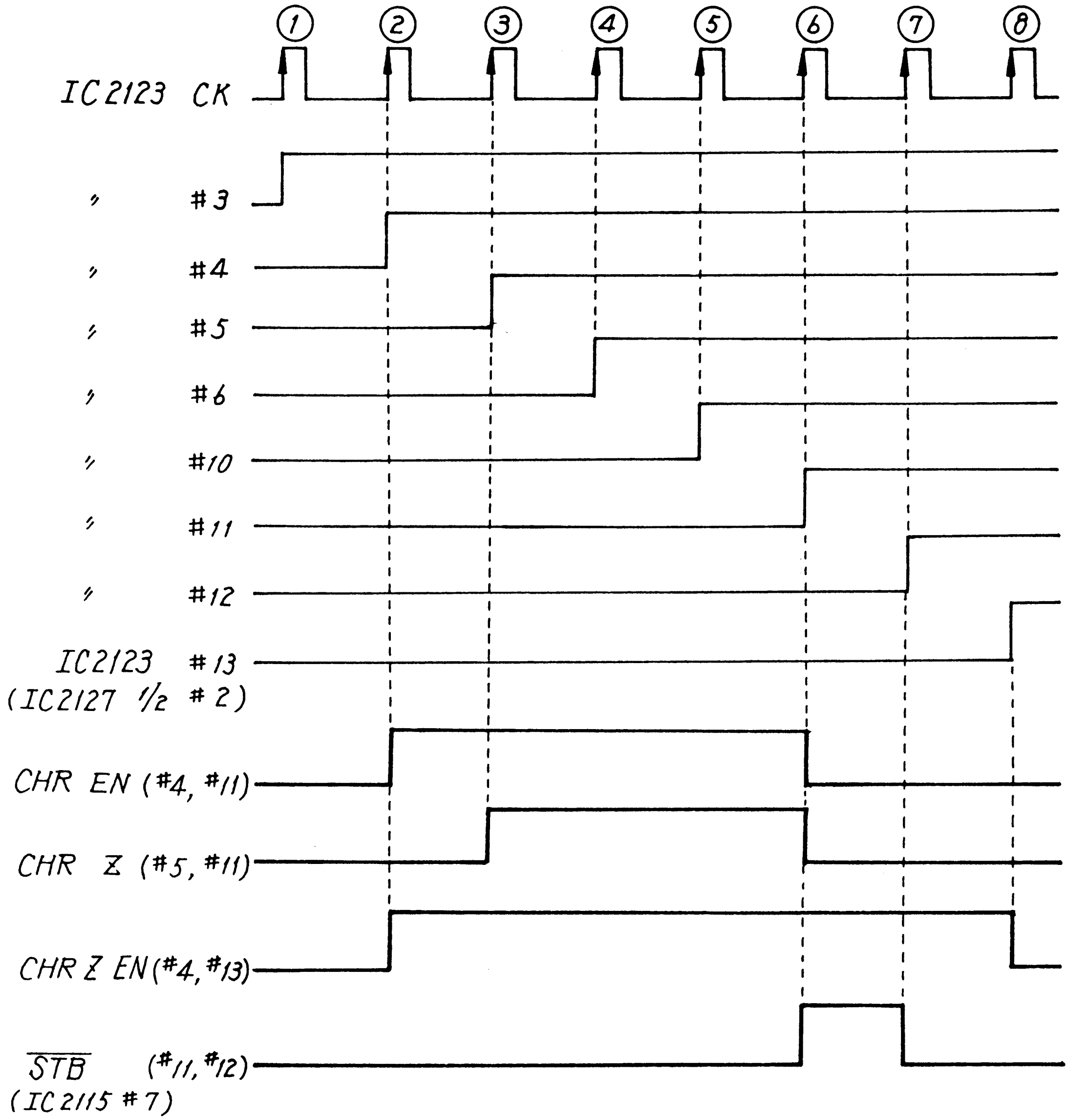


Fig. 6-22

(1) When the $\overline{STB}$ signal is "L":
One of inputs D0 to D7 of IC2115 is selected by the control signals A, B, and C, and fed out from Y.

(2) When the $\overline{STB}$ signal is "H":
$\overline{Y}$ of IC2115 becomes "L"; $\overline{Y}$ becomes "H".
Y is "H" ──► Pin 2 of IC2010 (4/4) is "H" ──► A single clock pulse of 4 MHz enters AL of counter IC2121. ──►
The clock pulse enters A1 of counter IC2121. ──►
Counter advances one more. ──► Each control signal $(C, B, A)_2$ of IC2115 advances one more. ──►
Since the $\overline{STB}$ signal is "H" only in a single clock pulse duration as shown above, the $\overline{STB}$ signal is reset to "L".

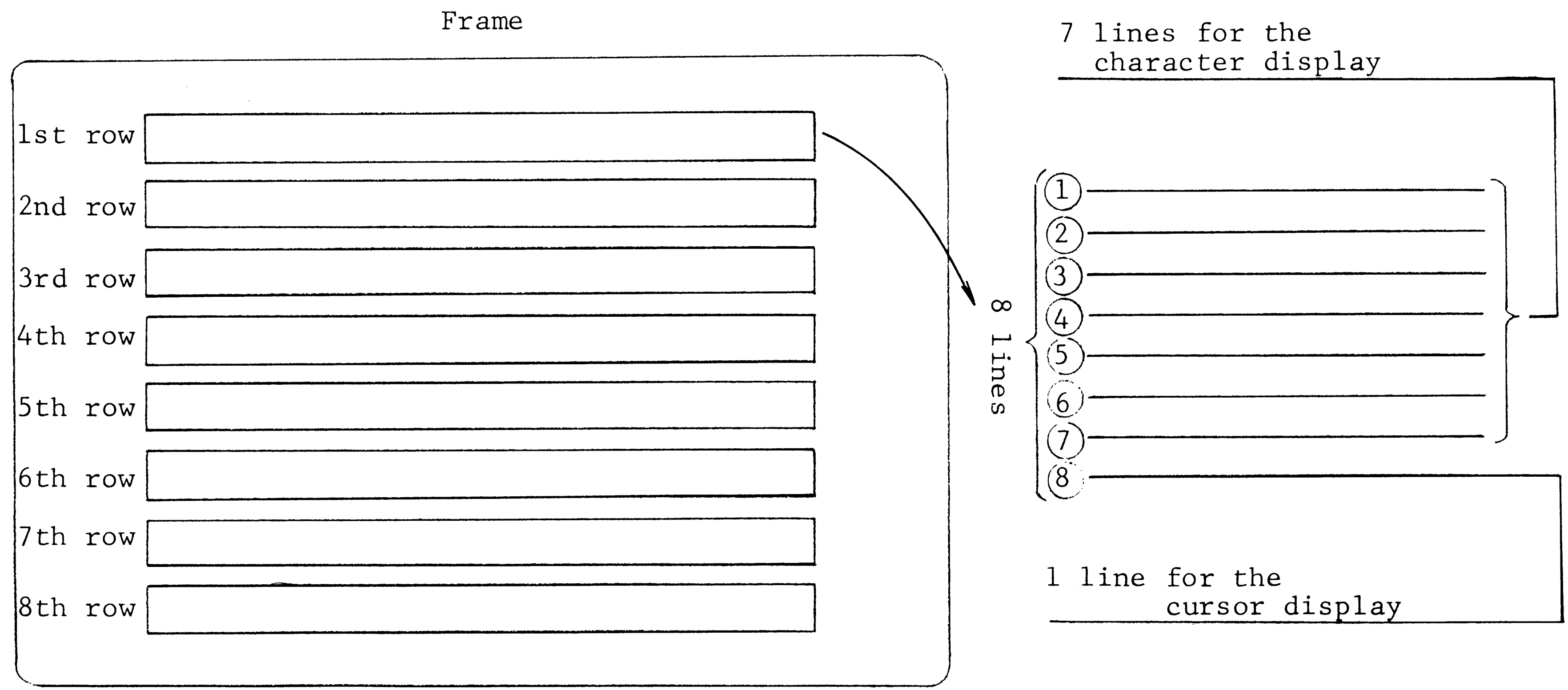
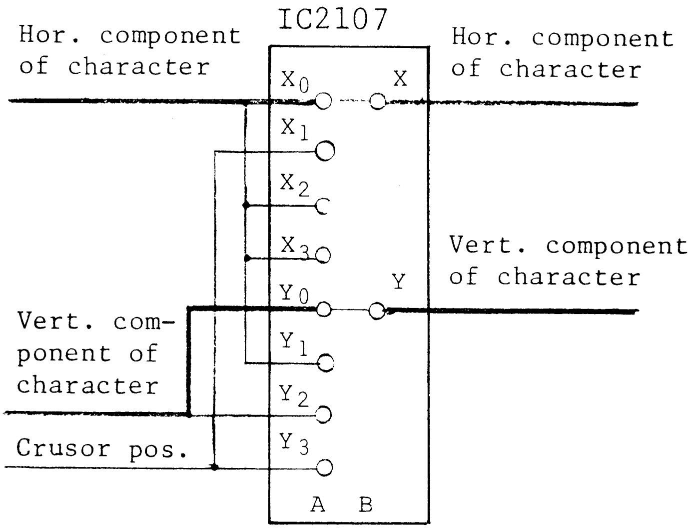


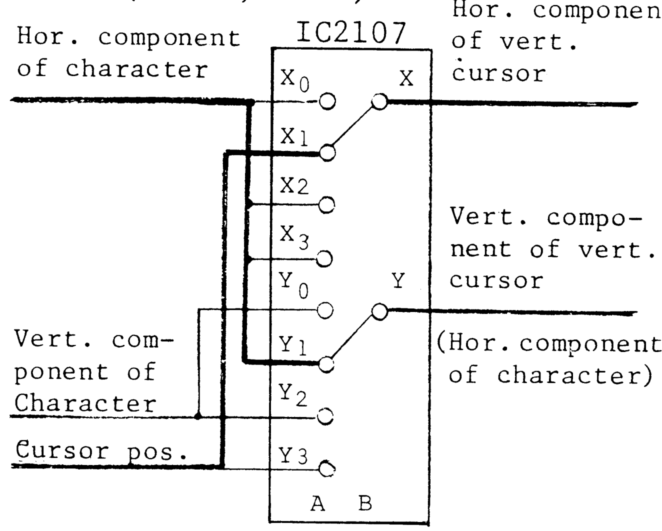
Fig. 6-23

13 V-1150

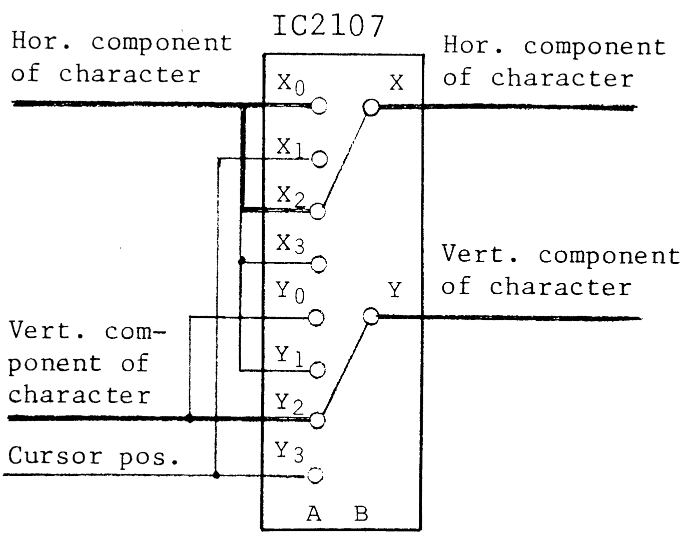
(1) A: "L", B: "L"



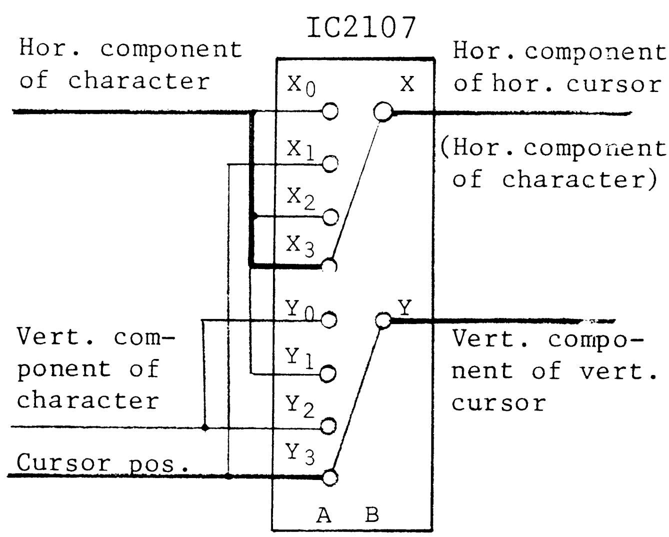
(2) Vertical cursor display (A:"H",B:"L")



(3) A: "L", B: "H"

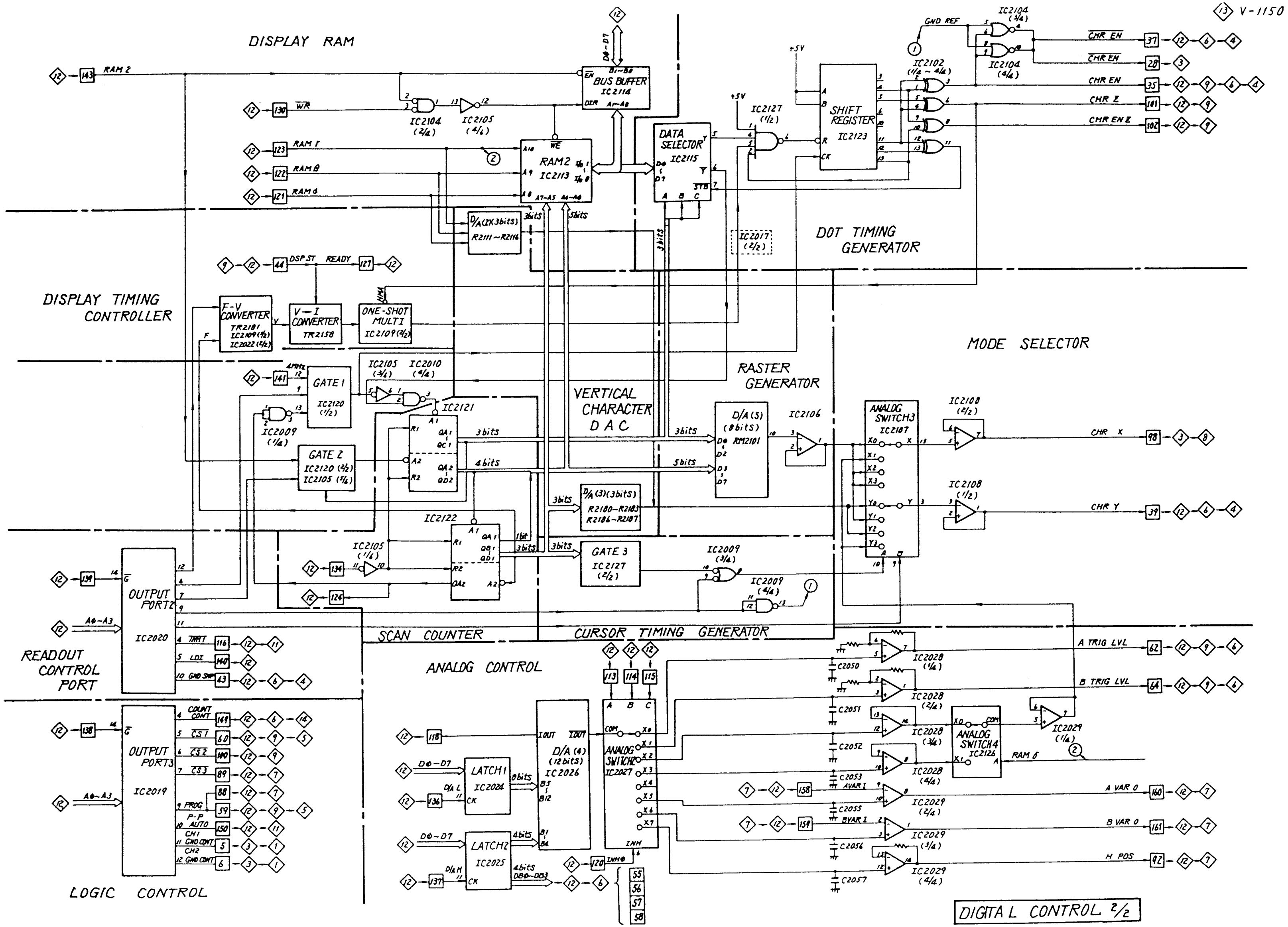


(4) Horizontal cursor display (A:"H", B:"H")



	Decimal	B	A	Connection state of analog SW		Display
		2^1	2^0	X	Y	
(1)	0	* 0	0	X_0	Y_0	Character
(2)	1	0	1	X_1	Y_1	Vertical cursor
(3)	2	* 1	0	X_2	Y_2	Character
(4)	3	1	1	X_3	Y_3	Horizontal cursor

Fig. 6-24



DIGITAL CONTROL 2/2

14 COUNTER (PEF-738)

This circuit has the following functions:

1. Measurement of the frequency and the period

1.1 Direct counting

With this method, the frequency is obtained by counting the number of the input pulses (trigger pulses) in a reference time (reference pulse width). The period is automatically obtained by the microcomputer from the equation
$T = 1/f$.

where, T = Period
f = Frequency

1.2 Indirect counting (reciprocal counter)

With this method, an input pulse (trigger pulse) is used as a reference time, and the frequency is obtained by counting the number of pulses of 1 MHz in the reference time. The period is directly read on the CRT screen from the relationship of 1 MHz = 1 μs.

2. Event counter

The number of the clock pulses in a designated period are counted.

2.1 EVENT IN DLY TIME

The number of the clock pulses in the period from the beginning of the A GATE to that of the B GATE are counted.

2.2 EVENT IN B TIME

The number of the clock pulses during the B GATE are counted.

Further descriptions on each circuit operation follow. Refer to the detailed block diagram Figure 6-25 and counter function Table 6-6.

1.1 Direct counting

The frequency and period of COUNT TRIG pulse (trigger pulse) fed to 73 are measured. The COUNT TRIG pulse is supplied to the COUNTER (19 bits) via the SELECTOR 1 and gate IC2413c.

On the other hand, a reference pulse is produced from the 1 MHz signal from 142 . The frequency of the 1 MHz signal is counted down by the TIME DIVIDER to be 1 kHz, 100 Hz, 10 Hz, and 1 Hz. A pulse whose frequency is most suitable for the measurement is automatically selected among these pulses by the SELECTOR 4. (In this case, the pulse width is left out of account.)

The selected pulse is supplied to the REF-PULSE GEN via gate IC2416c. The REF-PULSE GEN generates only one pulse having a width equal to of the selected pulse. This pulse is a reference pulse, and is supplied to the COUNTER (19 bits) via gates IC2413d and IC2413c. The COUNTER counts the input pulses (trigger pulses) in the reference pulse width, and delivers the result to the microcomputer as the COUNT DATA from 126 .

1.2 Indirect counting (reciprocal counter)

The COUNT TRIG pulse (trigger pulse) from 73 is supplied to the REF-PULSE GEN via the SELECTOR 2, the SELECTOR 4, and gate IC2416c. At the time, the frequency of the COUNT TRIG pulse is counted down to 1:1, 10:1, or 100:1. The REF-PULSE GEN generates only one pulse having a width equal to the period of the counted down COUNT TRIG pulse. This pulse is supplied to the COUNTER as a reference pulse via gates IC2413d and IC2413c.

On the other hand, the 1 MHz signal from 142 is supplied to the COUNTER via the SELECTOR 1 and gate IC2413c. The COUNTER counts the number of the input pulses (1 MHz pulses) in the reference pulse (trigger pulse). The relationship between the trigger pulse and the 1 MHz pulse in this case is just reciprocal to that in case 1.1 Direct counting.

2.1 EVENT IN DLY TIME (Event counting in the delay time)

The COUNT TRIG pulse (trigger pulse) from 73 is supplied to the COUNTER (19 bits) via the SELECTOR 1 and gate IC2413c. The COUNT A GATE signal from 76 is supplied to the SELECTOR 3 via the DELAY TIME GENERATOR. The COUNT B GATE signal from 80 is also supplied to the REF-PULSE GEN via the DELAY TIME GENERATOR.

A pulse having the width from the beginning of the A GATE to that of the B GATE is obtained at pin 15 of IC2413d. (See Figure 6-26.)
This pulse is a reference pulse, and is supplied to the COUNTER (19 bits) via gate IC2413c. The COUNTER counts the number of the COUNT TRIG pulses (trigger pulses) in the reference pulse.

2.2 EVENT IN B TIME (Event counter in the B GATE operation)

The COUNT TRIG pulse (trigger pulse) from [73] is supplied to the COUNTER (19 bits) via the SELECTOR 1 and gate IC2413c. The COUNT B GATE signal from [80] is supplied to the SELECTOR 3 and the REF-PULSE GEN via the DELAY TIME GENERATOR.
A single pulse having the time width equal to that of the B GATE signal is supplied from gate IC2413d. (See Figure 6-27.) This pulse is a reference pulse, and is supplied to the COUNTER (19 bits) via gate IC2413c.

See the circuit diagram ⟨14⟩ for the following operation.

IC2403a and IC2403b are flip-flop circuits. IC2403a counts down the frequency of an input signal to 2:1, and IC2403b controls so that a single pulse is generated. The count end pulse which is "L" only in the reference period is supplied to the collector of TR2402. The count end signal is fed out from [126] to the micro-computer in the circuit ⟨12⟩ as part of the COUNT DATA via ⟨6⟩ , and the microcomputer recognizes the end of counting. Then, the COUNT ST pulse is supplied to [135] from the microcomputer so that IC2403b is set.

IC2402a, IC2402b, and IC2401a are ECL type, and constitute a counter circuit. Three pairs of differential amplifiers match the DC level logically among ICs by converting the ECL levels to the TTL or C-MOS levels. IC2407 is a TTL type and IC2411 is a C-MOS type. IC2410, IC2411, and IC2412 are shift registers of C-MOS type, and perform the parallel/serial conversion (20 bits to 1 bit).
The COUNT D CK signal from [132] and the COUNT CONT signal from [149] are used for controlling the shift registers from the micro-computer.

The COUNT RES signal from [157] resets the COUNTER (19 bits). The COUNTER consists of the ECL, the TTL, and the C-MOS type ICs, and TR2409 matches the DC level among ICs logically. (The DC levels are changed from the TTL or the C-MOS level to the ECL level.)

As for the control signals COUNT RANGE 1, COUNT RANGE 2, COUNT MODE 1, COUNT MODE 2, COUNT MODE 3, and COUNT MODE 4, refer to Table 6-6.

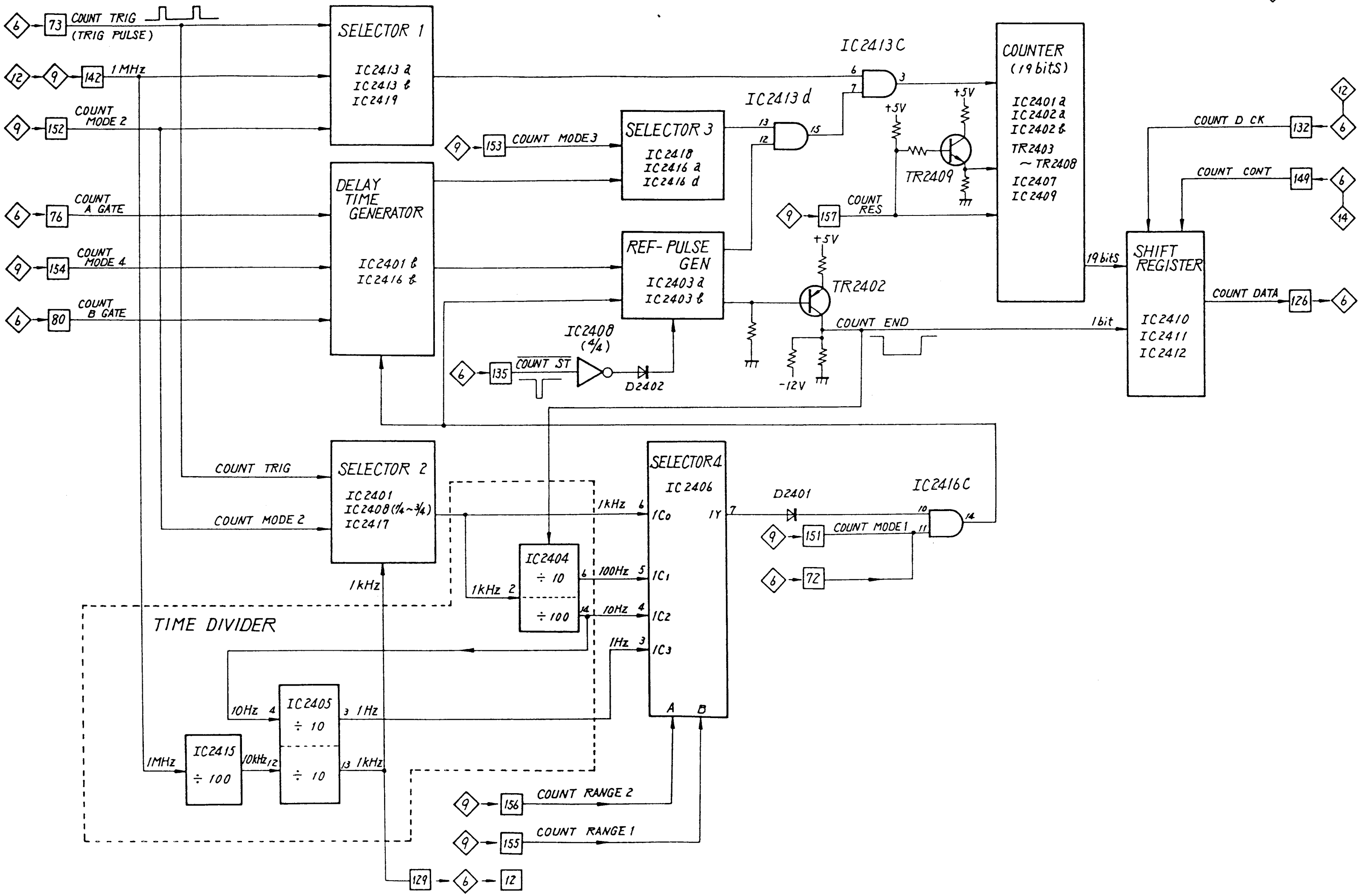

73
COUNT TRIG
(TRIG PULSE)
142
1MHz
152
COUNT MODE 2
76
COUNT A GATE
154
COUNT MODE 4
80
COUNT B GATE
SELECTOR 1
IC2413a
IC2413b
IC2419
DELAY TIME GENERATOR
IC2401b
IC2416b
153
COUNT MODE3
SELECTOR 3
IC2418
IC2416a
IC2416d
REF-PULSE GEN
IC2403a
IC2403b
IC2413C
IC2413d
+5V
TR2409
COUNT RES
157
TR2402
COUNT END
135
COUNT ST
IC2408 (4/4)
D2402
-12V
COUNTER (19 bits)
IC2401a
IC2402a
IC2402b
TR2403 ~ TR2408
IC2407
IC2409
19 bits
1 bit
SHIFT REGISTER
IC2410
IC2411
IC2412
COUNT D CK
132
COUNT CONT
149
COUNT DATA
126
SELECTOR 2
IC2401
IC2408 (1/4~3/4)
IC2417
COUNT TRIG
COUNT MODE 2
1kHz
TIME DIVIDER
IC2404
÷ 10
÷ 100
1kHz
100Hz
10Hz
1Hz
IC2405
÷ 10
÷ 10
IC2415
÷ 100
1MHz
10kHz
SELECTOR4
IC2406
1C0
1C1
1C2
1C3
1Y
A
B
D2401
IC2416C
COUNT MODE 1
151
72
156
COUNT RANGE 2
155
COUNT RANGE 1
129
12

Fig.6-25

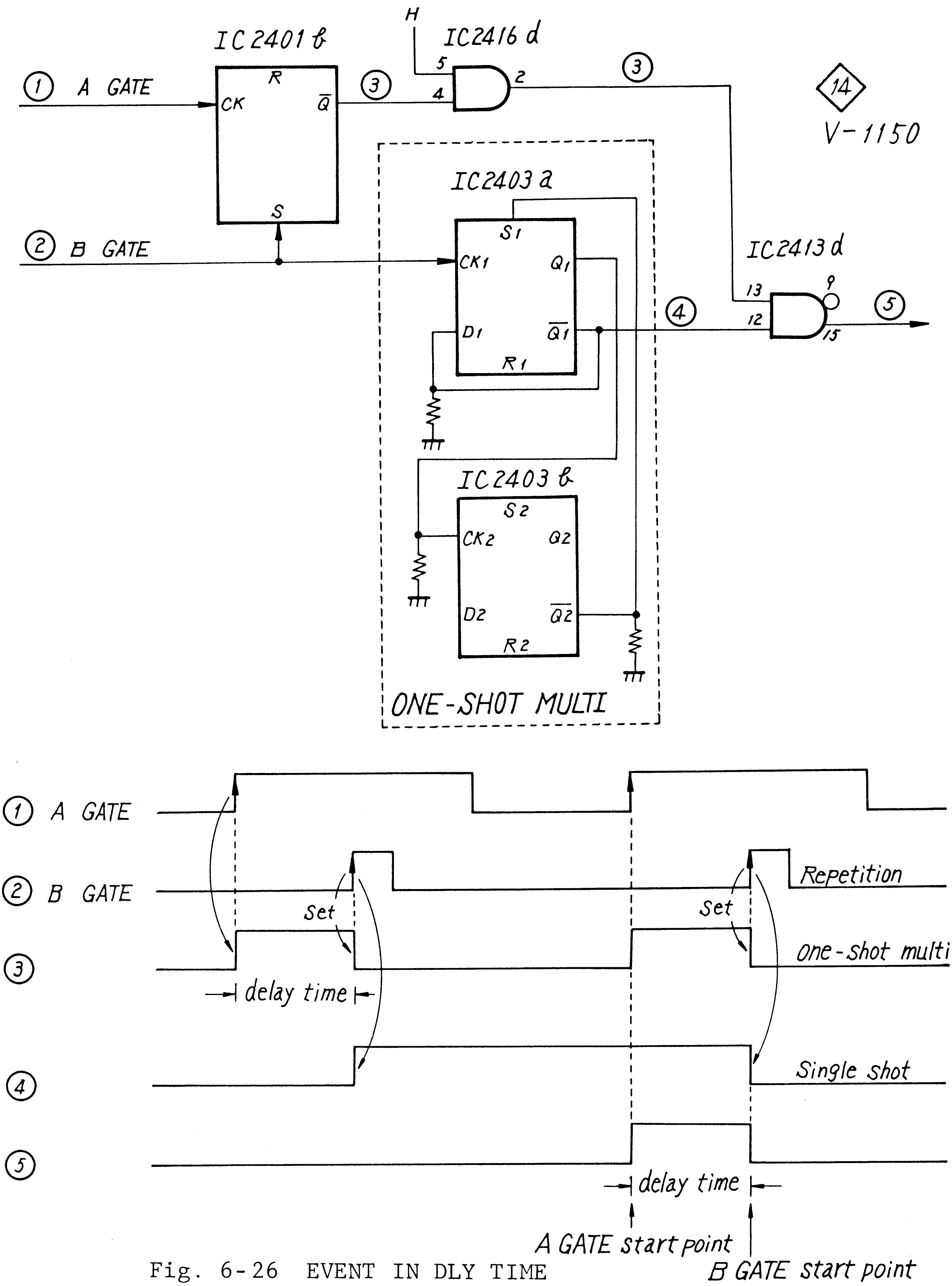
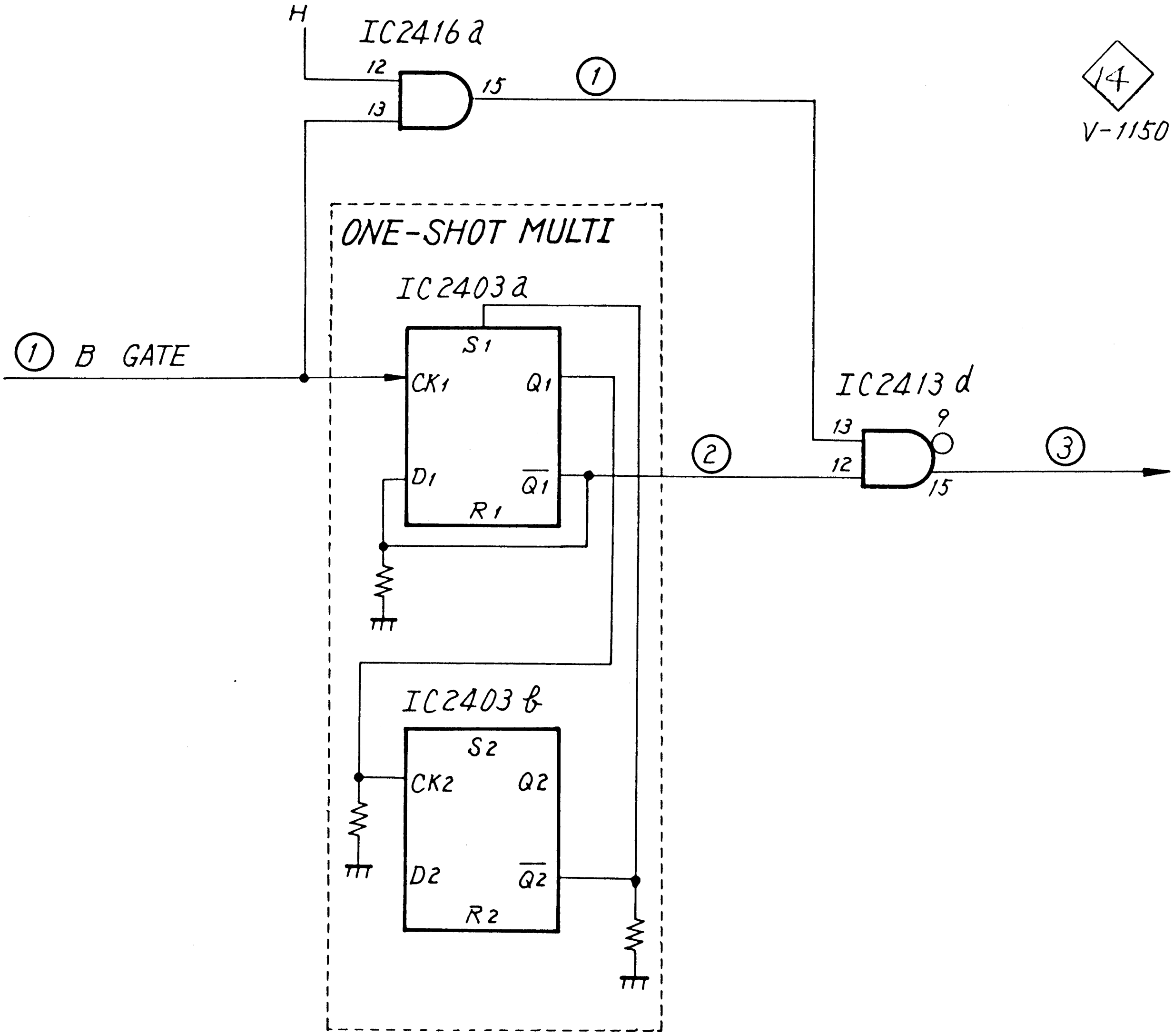


Fig. 6-26 EVENT IN DLY TIME



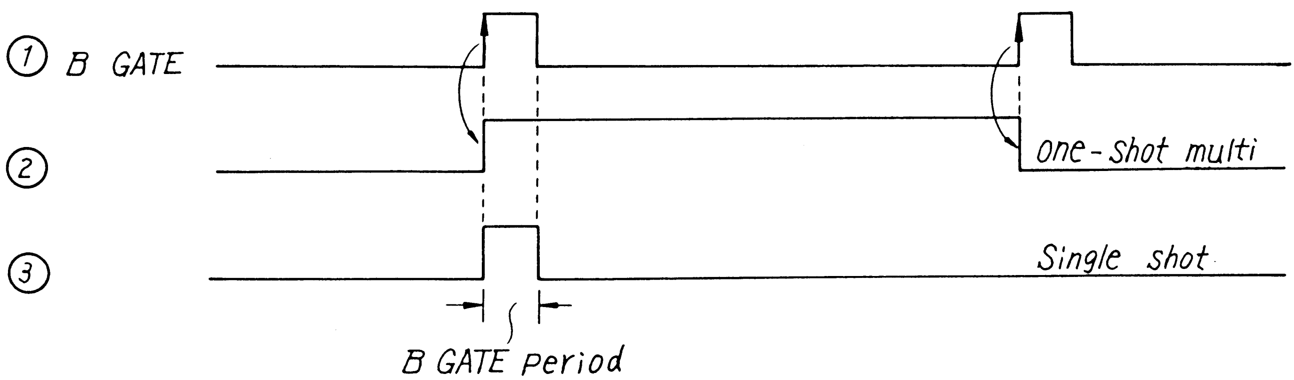


Fig. 6-27 EVENT IN B TIME

Table 6-6

Function	Auto range (Hz)	COUNTER CONT CTR RANG 1	CTR RANG 2	CTR MODE 1	CTR MODE 2	CTR MODE 3	CTR MODE 4	Count-down of signal to be measured	Reference frequency	Number of counts	Display	Resolution	Time for measurement	Remarks
Frequency and Period — Direct counting	150M to 100M	L	L	H	L	H	H	÷ 1	1kHz	150000 to 10000	150.000 to 100.000MHz	1kHz	1mS	Period:1/f
	100M to 10M	L	L	H	L	H	H	"	1kHz	99999 to 10000	99.999 to 10.000MHz	1kHz	1mS	
	10M to 1M	L	H	H	L	H	H	"	100 Hz	"	9.9999 to 1.0000MHz	100 Hz	10mS	
	1M to 100k	H	L	H	L	H	H	"	10 Hz	"	999.99 to 100.00kHz	10 Hz	100mS	
	100k to 10k	H	H	H	L	H	H	"	1 Hz	"	99.999 to 10.000kHz	1 Hz	1 S	
Frequency and Period — Reciprocal method (Direct counting)	10k to 10k	H	L	H	H	H	H	÷ 100	1MHz	10000 to 99999	9.9999 to 1.0000kHz	Max 1Hz Min 0.1Hz	0.1 S	Frequency: reciprocal of the number of counts
	1k to 100	L	H	H	H	H	H	÷ 10	"	"	999.99 to 100.00 Hz	Max 0.1Hz Min 0.01Hz	0.1 S	
	100 to 10	L	L	H	H	H	H	÷ 1	"	"	99.999 to 10.000 Hz	Max 0.01Hz Min 0.001Hz	0.1 S	
	10 to 1	H	H	H	H	H	H	÷ 1	"	"	9.9999 to 1.0000	Max 0.001Hz Min 0.0001Hz	1 S	
Event counter 1 (in DLY time)	The number of pulses between A GATE START and B GATE START is counted.	-	-	L	L	H	L	÷ 1	—	99999 to 0	99999 to 0	—	—	
Event counter 2 (in B time)	The number of pulses between B GATEs is counted.	-	-	L	L	L	H	÷ 1	—	99999 to 0	99999 to 0	—	—	

⟨15⟩ DVM (PEF-733, 734)

This circuit is a digital voltmeter circuit. Measurement is performed through the CH2 connector, and the effective value of the sine wave of 10 MHz maximum can be measured.
Figure 6-28 shows a detailed block diagram of this circuit. The CH2 SIG from [19] is supplied to the AMP 1 via buffer TR2501. The CH2 SIG is supplied in the direction of arrow ⇨, and part of the signal is negative fed back in the direction of arrow ➡ via R2505. R2502//R2506 and R2505 determine the amount of the feedback, and the voltage gain G_v is obtained as follows:

$$G_v = \frac{R2502//R2506 + R2505}{R2502//R2506} = 9.4 \text{ (times)}$$

Since the output from the AMP (1) flows to C2515, its AC component is only supplied to the base of TR2505. The AC component is supplied to the two-stage AC amplifier consisting of TR2505 and TR2506 in the direction of arrow ⇨.
DC AMP IC2501a keeps the bias voltage so that the two-stage AC amplifier operates stably. That is, the DC AMP keeps the voltage at point (d) equal to that at point (c) (4 V approximately, constant).

Since the output from the two-stage AC amplifier flows across C2526, its AC component is only supplied to the RECTIFIER CIRCUIT in the following stage. When the signal is "H," the current i_1 flows, and C2536 is charged. When the signal is "L," the current i_2 flows, and C2529 is charged. C2529 and C2536 are discharged in the direction of arrow ---> via R2538. The currents i_1 and i_2 are proportional to the voltage of the signal fed to point (b). Since the currents i_1 and i_2 flow across R2536, the voltage at point (e) changes in proportion to the signal fed to point (b).

The voltage at point (e) is negative fed back to point (b) in the direction of arrow ➡ via R2530. The DC voltages developed at points (g) and (f) are supplied to DIFF AMP IC2501b, and the voltage difference (DC) between them is supplied. If the voltage at point (g) is E_1, the voltage at point (f) is $-E_1$. The voltages at points (h) and (i) are $E_{1/2}$ and $-E_{1/2}$, respectively, and $2E_1$ is supplied to point (j). As shown above, the DC voltage corresponding to the AC component of the CH2 SIG is supplied from the DIFF AMP, and is supplied to ANALOG SWITCH IC2571.

ACV RV2572 adjusts characteristic variation of the rectifier circuit. ANALOG SWITCH IC2571 is controlled by the DVM CONT signal from [86] . When the DVM CONT signal is "L," the signal fed to terminal X_0 is supplied from the ANALOG SWITCH. When the DVM CONT signal is "H," the signal fed to terminal X_1 is supplied. To terminal X_1, the CH2 SIG with the input coupling mode set to DC is supplied.

The analog signal from the ANALOG SWITCH is supplied to A/D CONVERTER IC2572, and is converted to a digital signal. IC2572 is a double integration A/D converter, and its pin 14 momentarily becomes "L" after the analog signal has been converted into the digital signal. At the time, the END CON signal (end of conversion) from [87] becomes "H" momentarily. To pin 2 of ANALOG CONVERTER IC2572, the reference voltage (200 mV DC) is supplied.

Terminals DS1, DS2, DS3, and DS4 denote 10^3, 10^2, 10^1, and 10^0 digits, respectively. Data "1" is set to one of terminals DS1 to DS4, and the figure corresponding to the digit for 1 is denoted with terminals Z_0 to Z_3 (four bits). The digital signal from the A/D CONVERTER is supplied to SHIFT REGISTER IC2574, and is converted from parallel data (8 bits) to serial data (1 bit). The signal is then supplied from [128] as the DVM DT signal. The DVM CK from [133] is a clock pulse, and the DVM P/S from [85] is a control signal.

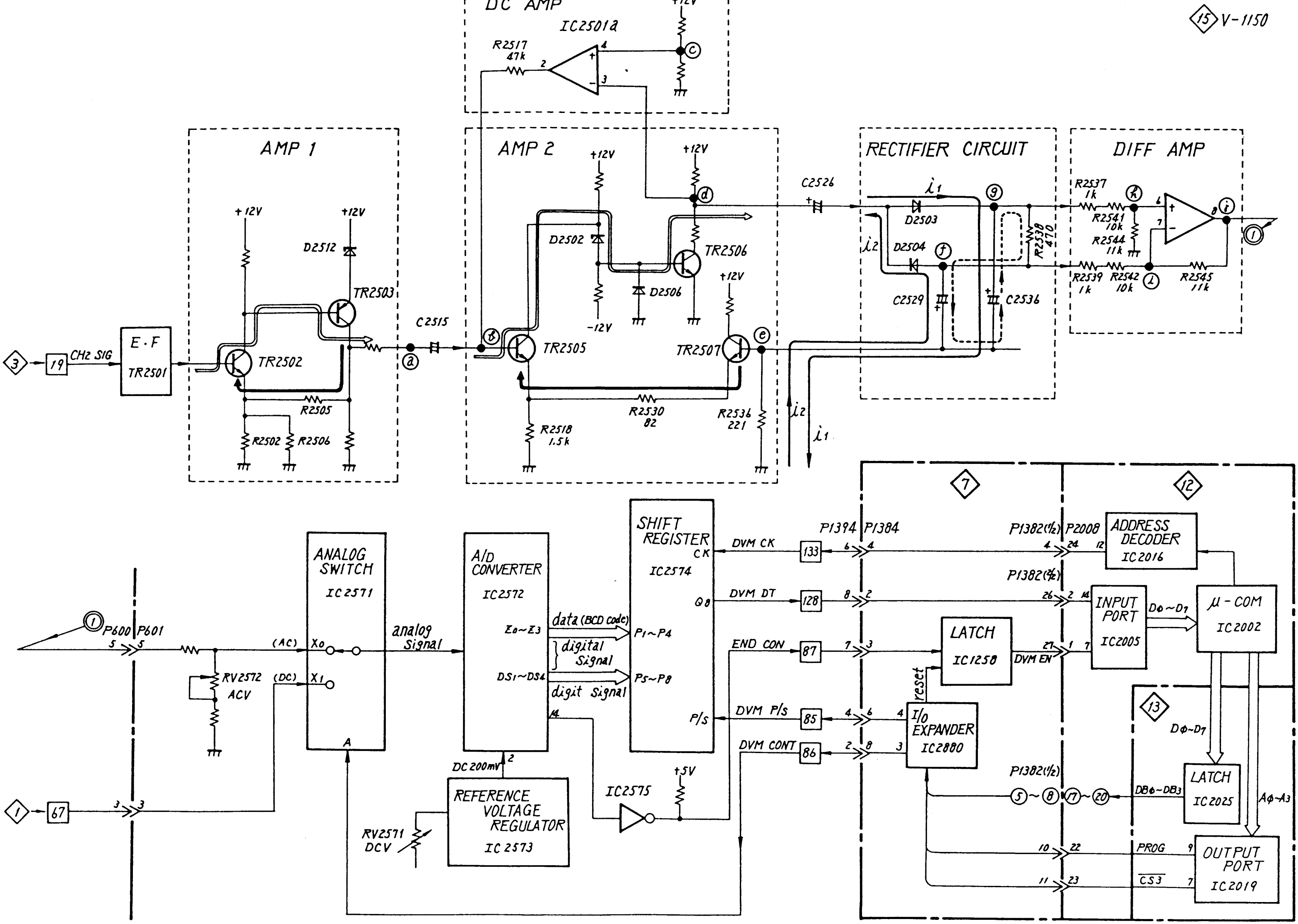
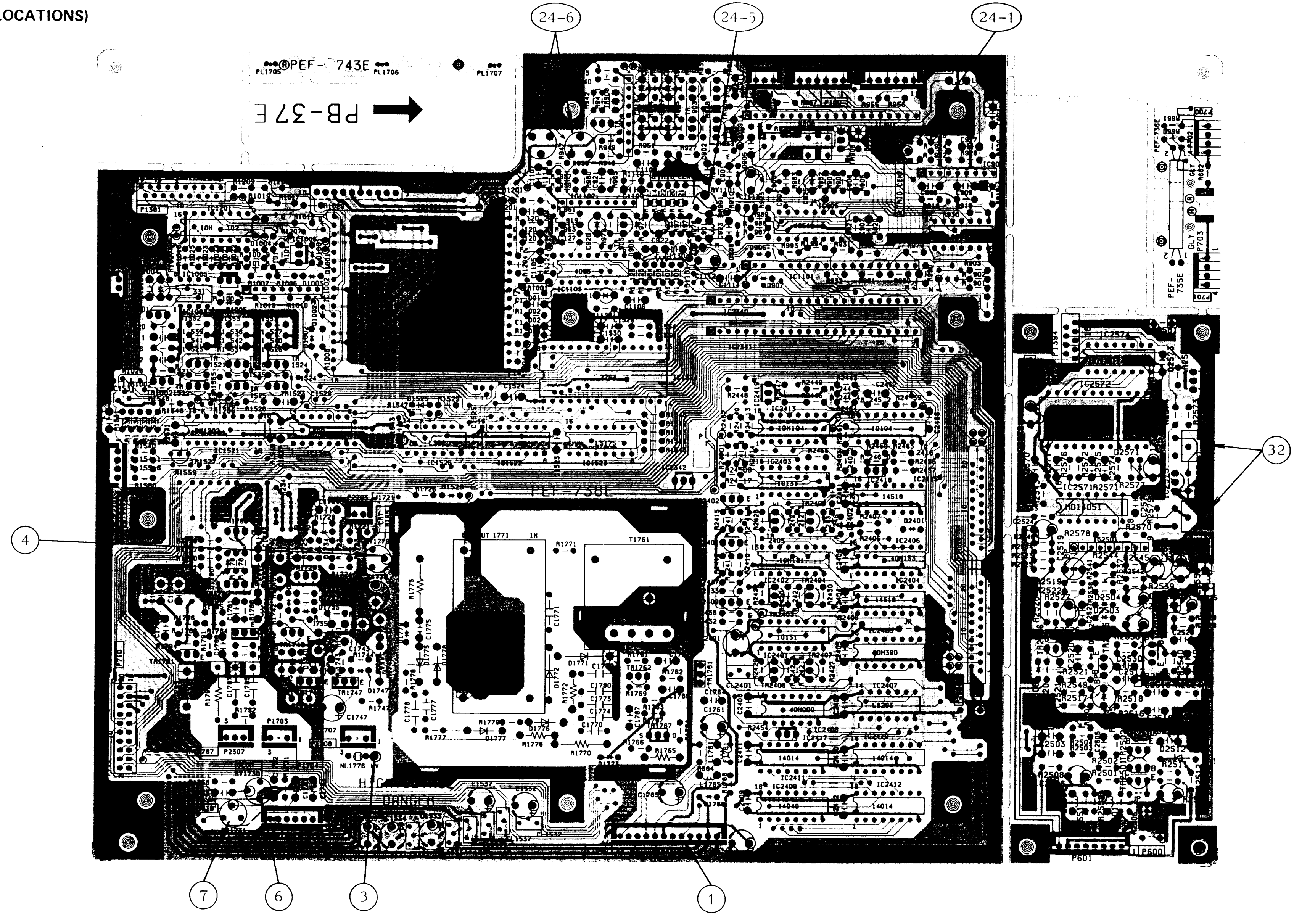
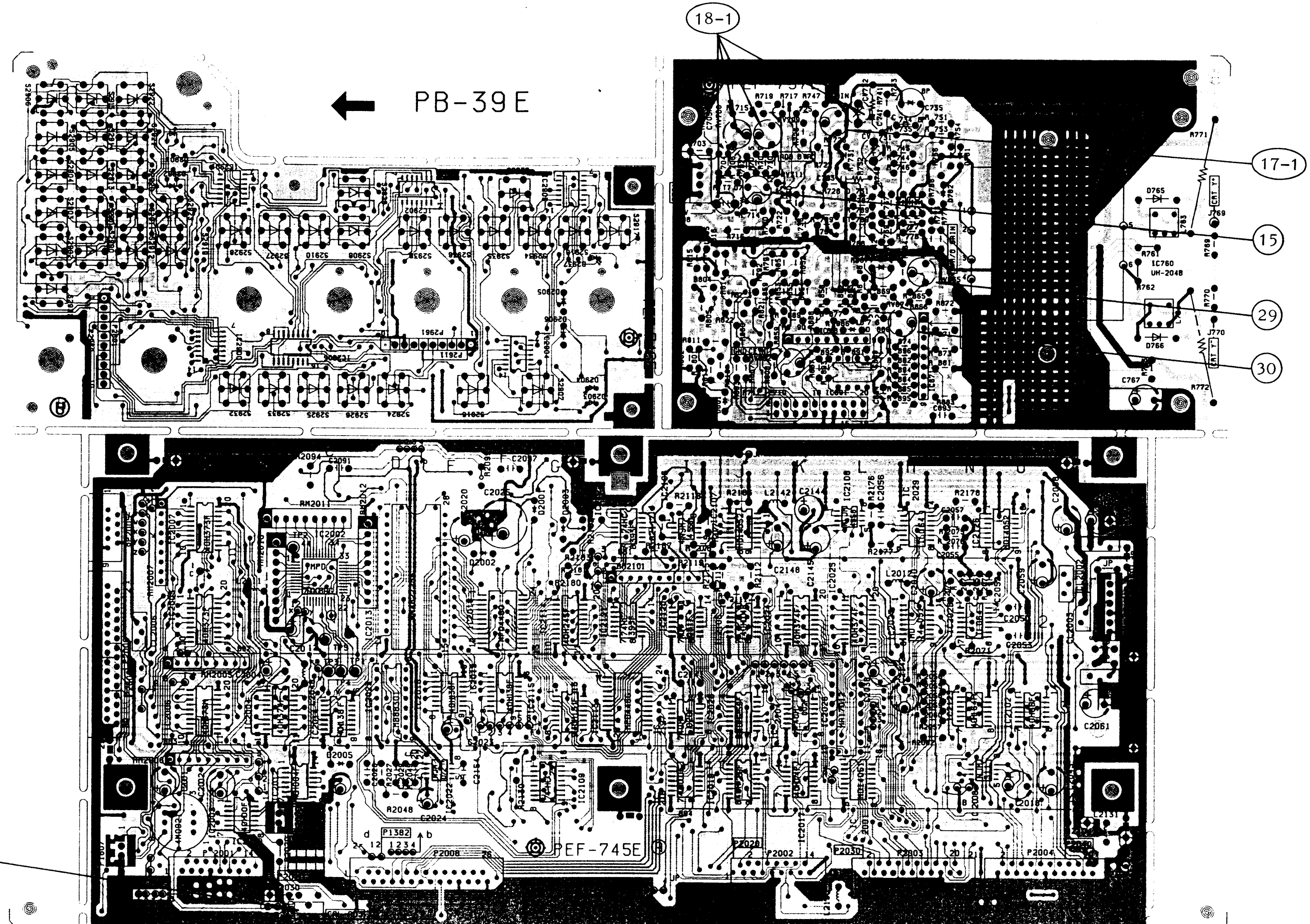

DC AMP
IC2501a
R2517 47k
AMP 1
AMP 2
RECTIFIER CIRCUIT
DIFF AMP
E・F TR2501
CH2 SIG
TR2502
TR2503
D2512
R2505
R2502
R2506
C2515
TR2505
D2502
D2506
TR2506
TR2507
R2518 1.5k
R2530 82
R2536 221
C2526
D2503
D2504
C2529
C2536
R2538 470
R2537 1k
R2541 10k
R2544 11k
R2539 1k
R2542 10k
R2545 11k
+12V
-12V
ANALOG SWITCH IC2571
A/D CONVERTER IC2572
SHIFT REGISTER IC2574
REFERENCE VOLTAGE REGULATOR IC 2573
RV2571 DCV
RV2572 ACV
DC 200mV
P600 P601
(AC)
(DC)
analog signal
data (BCD code)
digital Signal
digit signal
DVM CK
DVM DT
END CON
DVM P/S
DVM CONT
IC2575
+5V
P1394 P1384
P1382(1/2) P2008
ADDRESS DECODER IC2016
INPUT PORT IC2005
μ-COM IC2002
LATCH IC1250
DVM EN
reset
I/O EXPANDER IC2880
LATCH IC2025
OUTPUT PORT IC2019
DB0~DB3
D0~D7
A0~A3
PROG
CS3

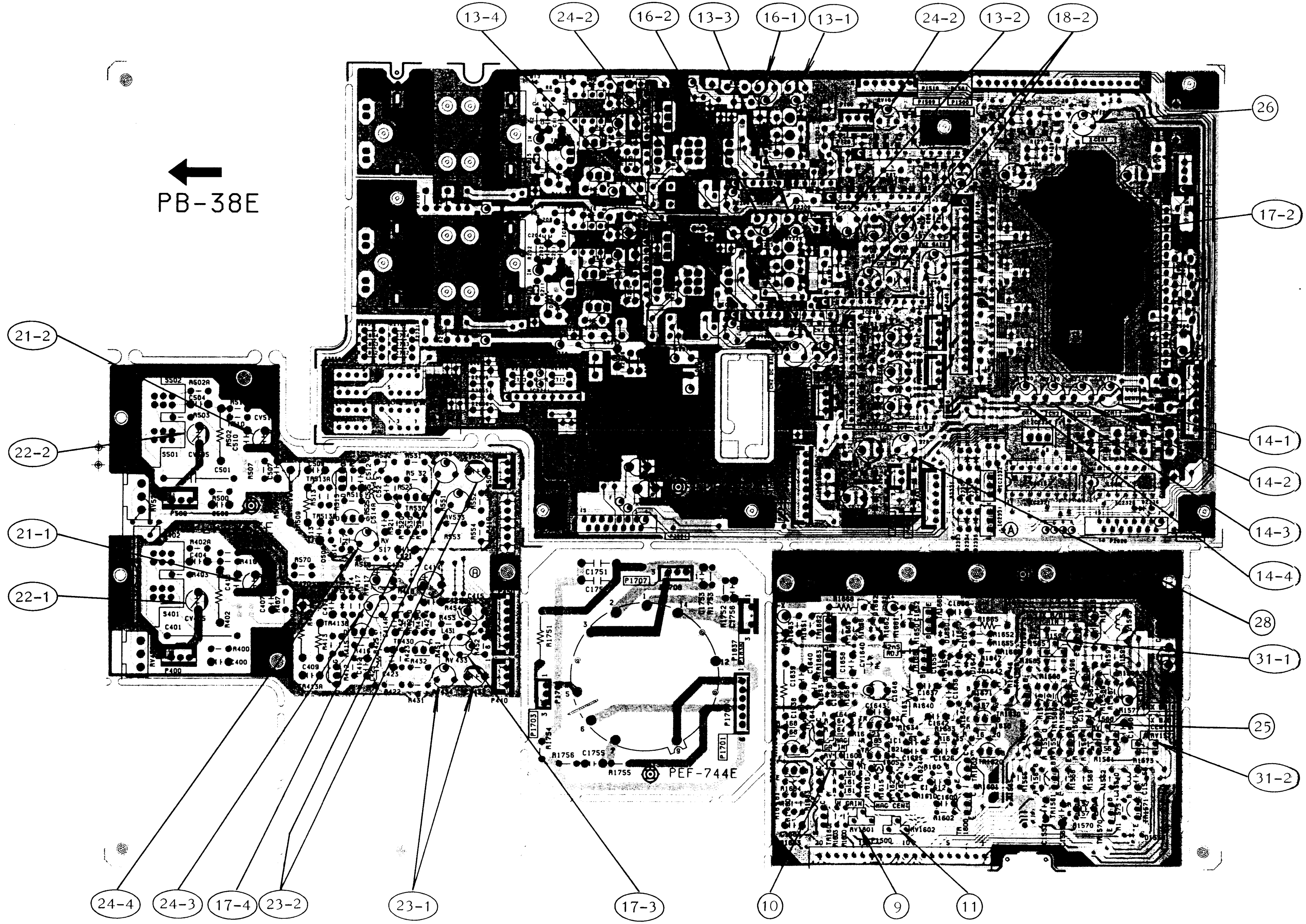
Fig. 6-28

7. ELECTRICAL PARTS ARRANGEMENT (WITH ADJUSTMENT LOCATIONS)

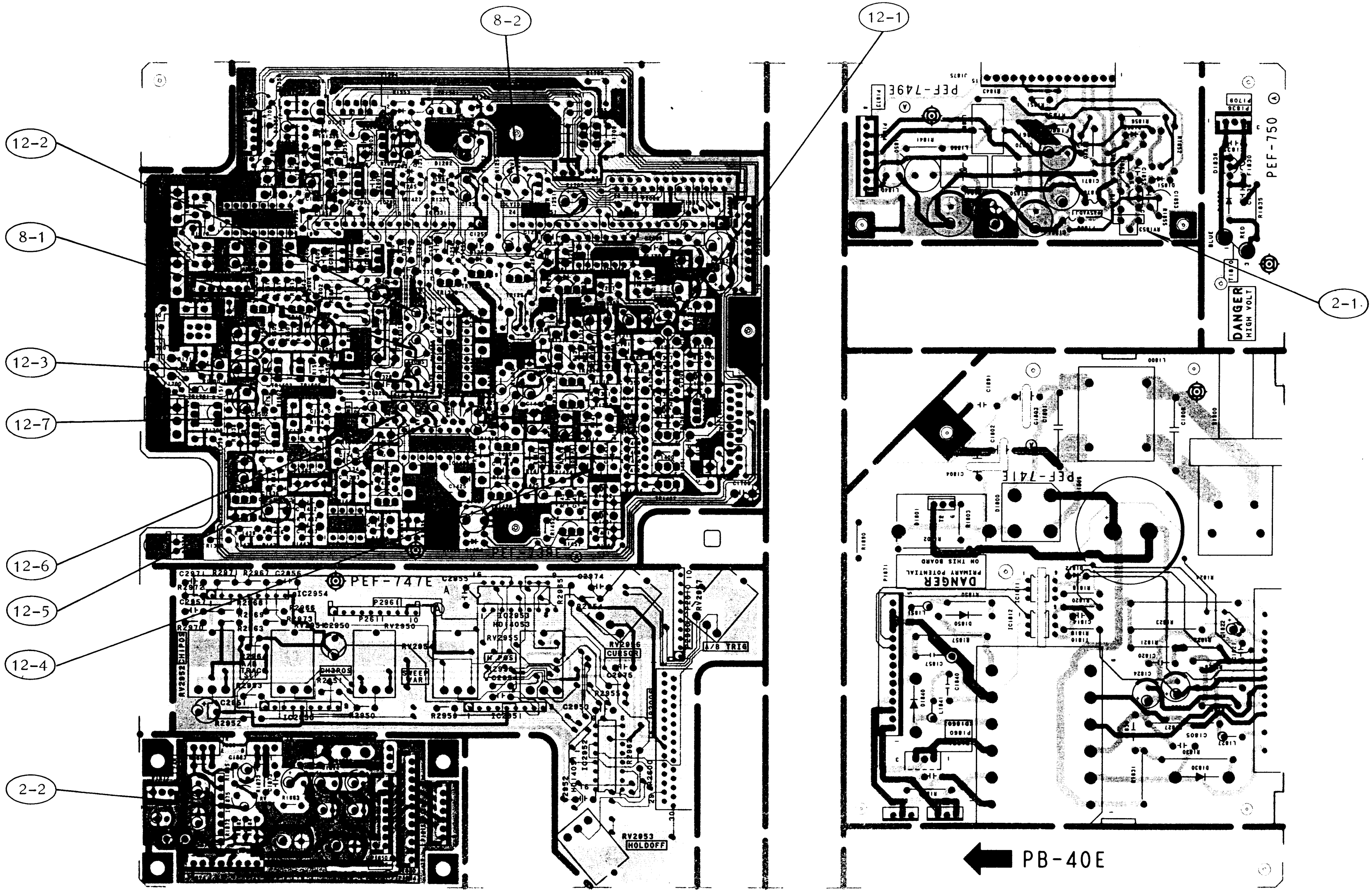




PB-39E
PEF-745E
18-1
17-1
15
29
30
27



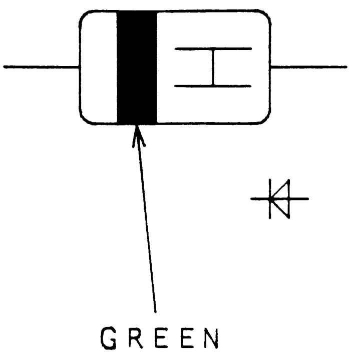
PB-38E
PEF-744E
13-4
24-2
16-2
13-3
16-1
13-1
24-2
13-2
18-2
26
17-2
21-2
22-2
21-1
22-1
14-1
14-2
14-3
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31-2
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17-4
23-2
23-1
17-3
10
9
11



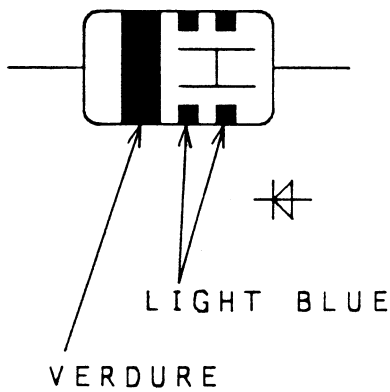
8-2
12-1
12-2
8-1
12-3
12-7
12-6
12-5
12-4
2-2
2-1
PEF-749E
PEF-750
DANGER
HIGH VOLT
PEF-741E
DANGER
PRIMARY POTENTIAL
ON THIS BOARD
PEF-747E
A/B TRIG
CURSOR
HOLDOFF
CHIPOS
SWEEP VAR
PB-40E

8. ELECTRICAL PARTS LEAD CONFIGURATIONS

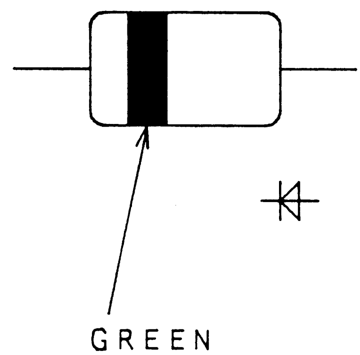
1S2075K



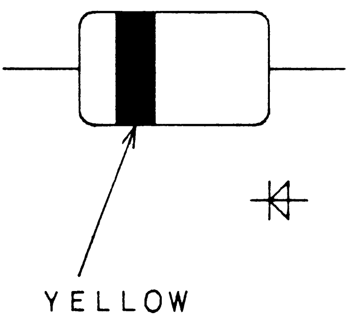
1SS83



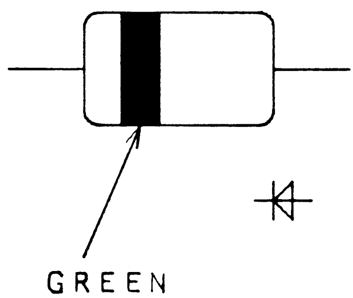
1SS110



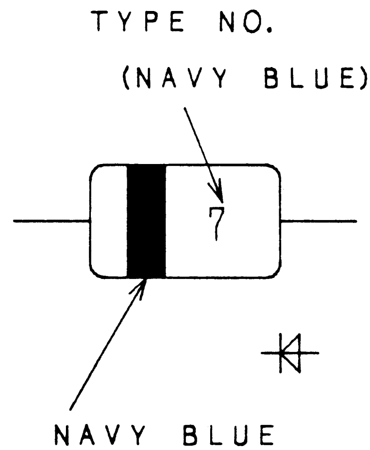
1SS133



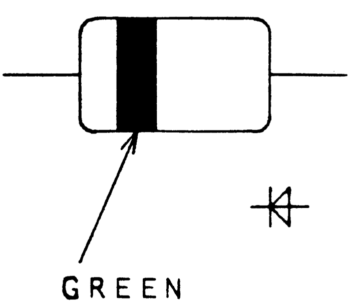
1SS165



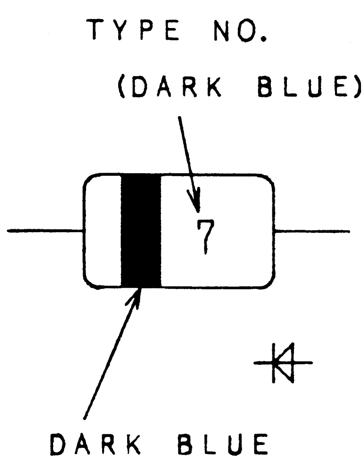
HZ-SERIES



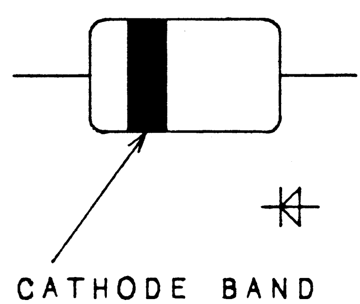
MA161



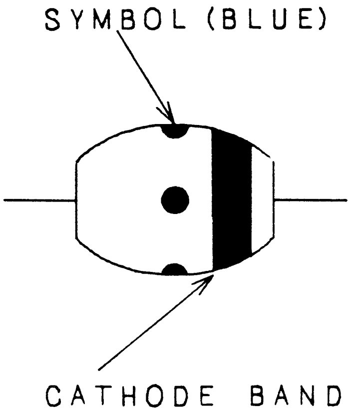
MTZ-SERIES



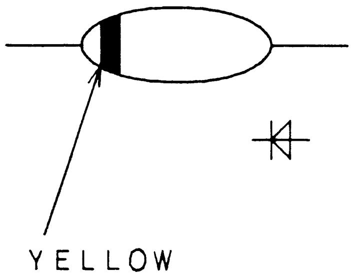
RK14



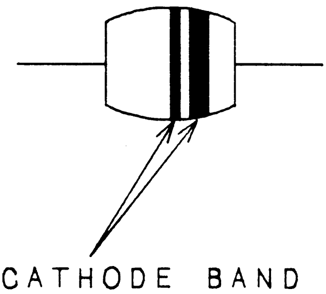
V09C
V09E



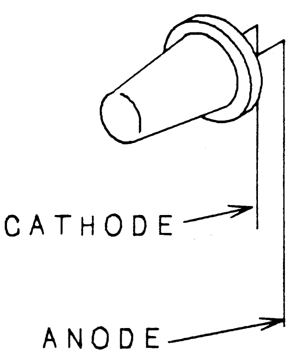
Y-10GA



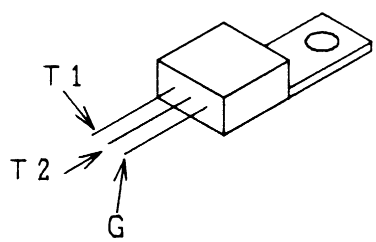
U07L



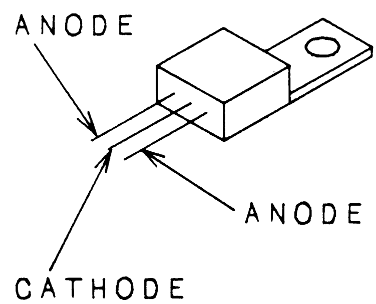
LN31GPHL



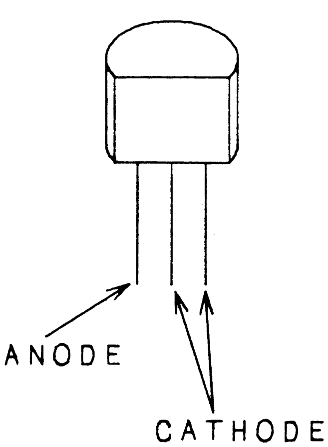
DTA10E



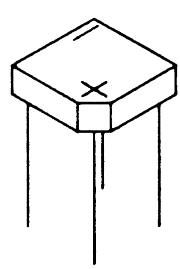
SB50-18



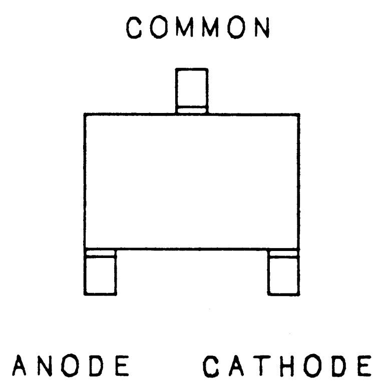
SB10-05H



DBA40K-15

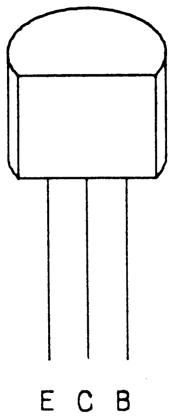


HSM88S

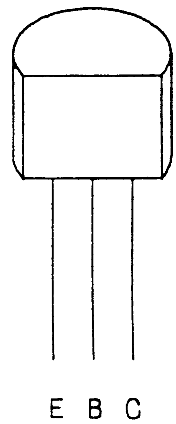


TOP VIEW

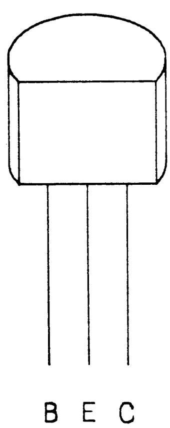
STANDARD



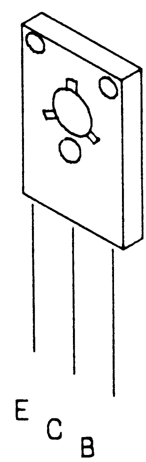
2SA1206



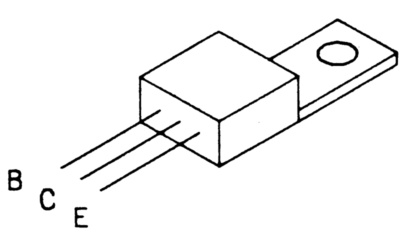
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2SC2026
2SC2408



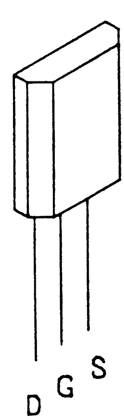
2SA1210S
2SC2912



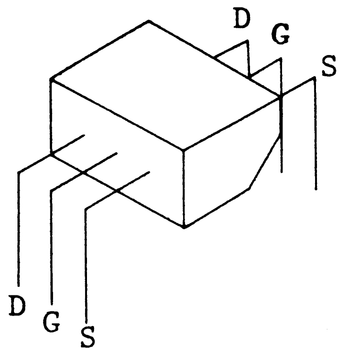
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2SD1668R



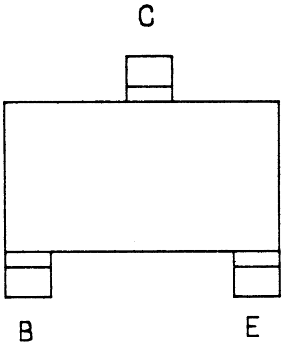
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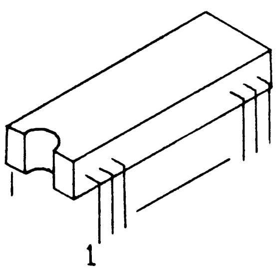
2SK332E



2SA1052
2SA1424
2SA1462
2SC2351
2SC2618RC-TR
2SC2735JC
2SC3356



TOP VIEW



8PINS

μPC398C

18PINS

BM1202A

14PINS

TC40H000P

HD74LS00P

HD74LS02P

HD74LS293P

16PINS

TC40H390P

TC40H153P

HD10104

HD10131

HD74LS175P

MC10H102L

MC10H104L

MC10H131L

HD14014BP

HD14015BP

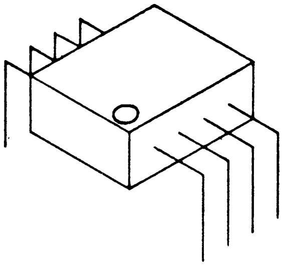
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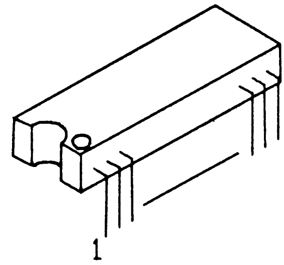
HD14051BP

HD14053BP

HD14518BP

HD14529BP





6PINS

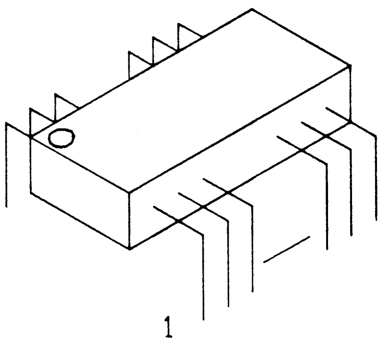
S22MD1

8PINS

NJM311D

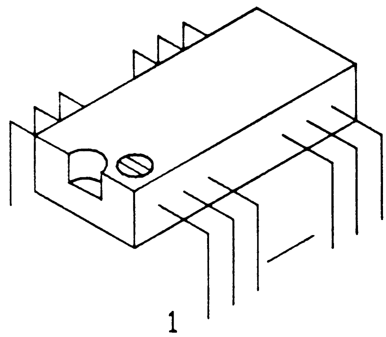
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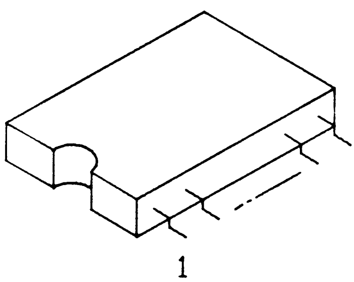
16PINS

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20PINS

HA17012PB



14PINS

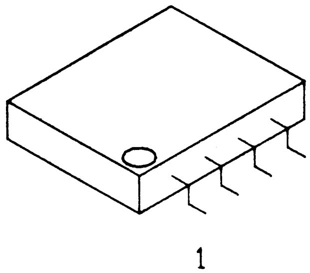
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TC40H002F
TC40H004F
TC40H074F
TC40H020F
TC40H164F
TC40H051F
TC74HC86F

16PINS

TC40H138F
TC40H259F
TC40H148F
TC40H151F
TC74HC123F

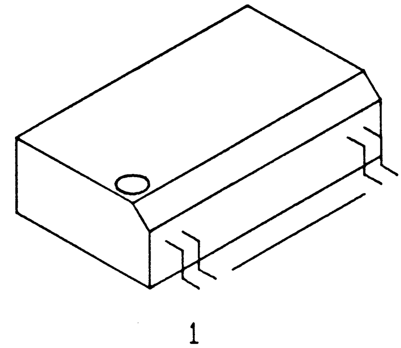
20PINS

TC40H245F
TC40H373F
TC40H374F



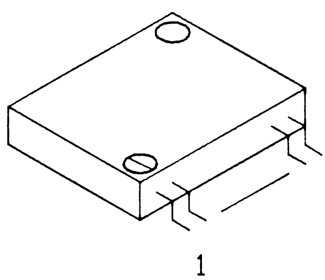
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NJM072M
NJM4558M
NJM311M



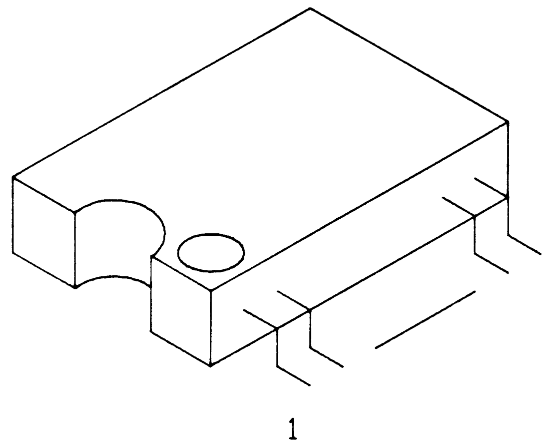
14PINS

DN74LS1645
MN74HC393S
TL064CNS



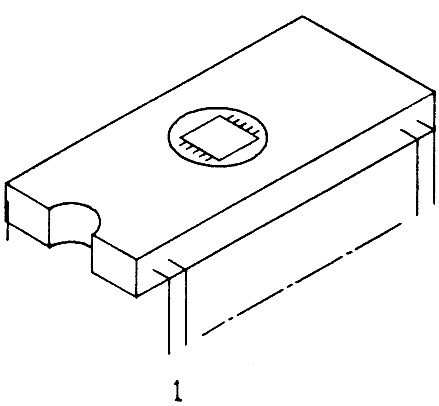
16PINS

HD14051BFP
HD14052BFP



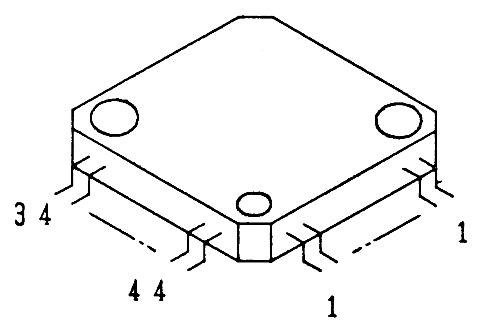
24PINS

μPD446G-20



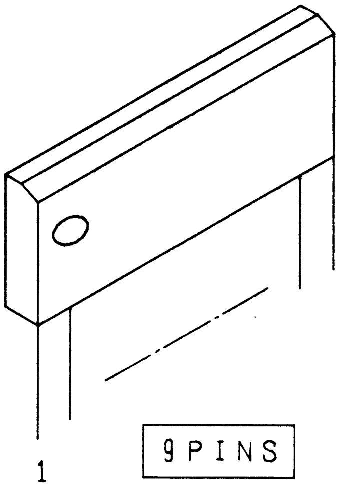
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HN482764G-4
HN27256G-30

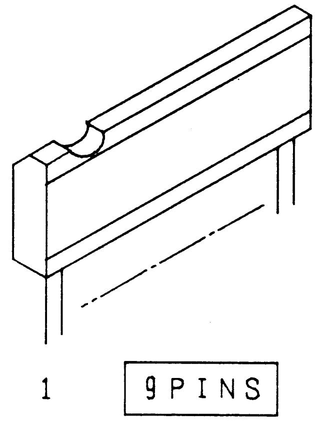


44PINS

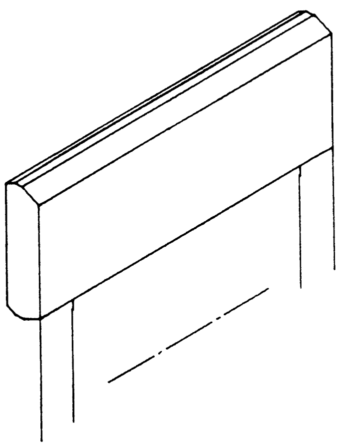
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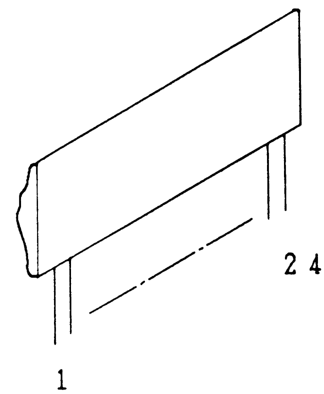
NJM072S
NJM2903S
NJM2904S



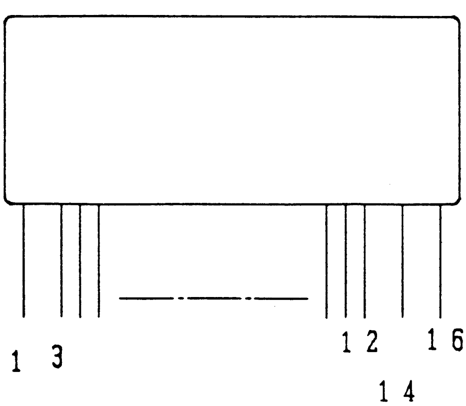
BA715



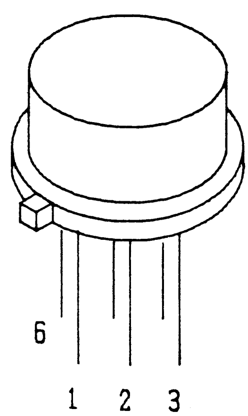
M5230L



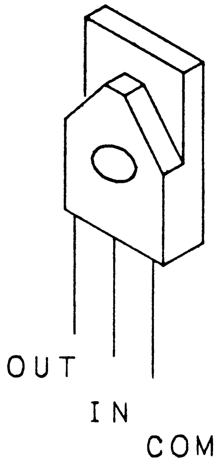
M57902L



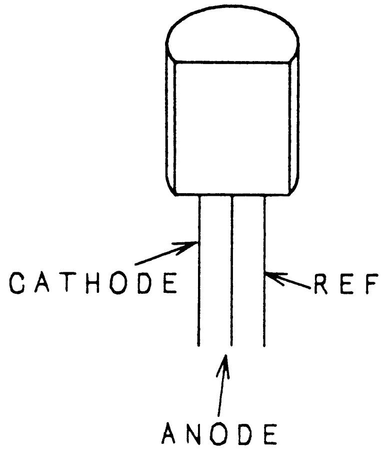
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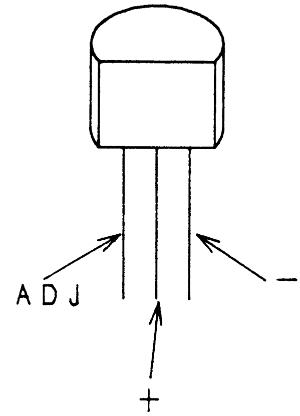
LQV-4M00-12



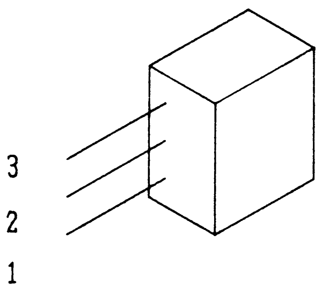
SI-3052V



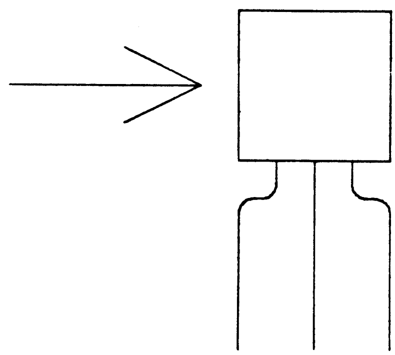
TL431CLP-B



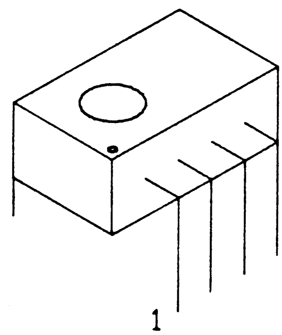
LM336Z



UN4213

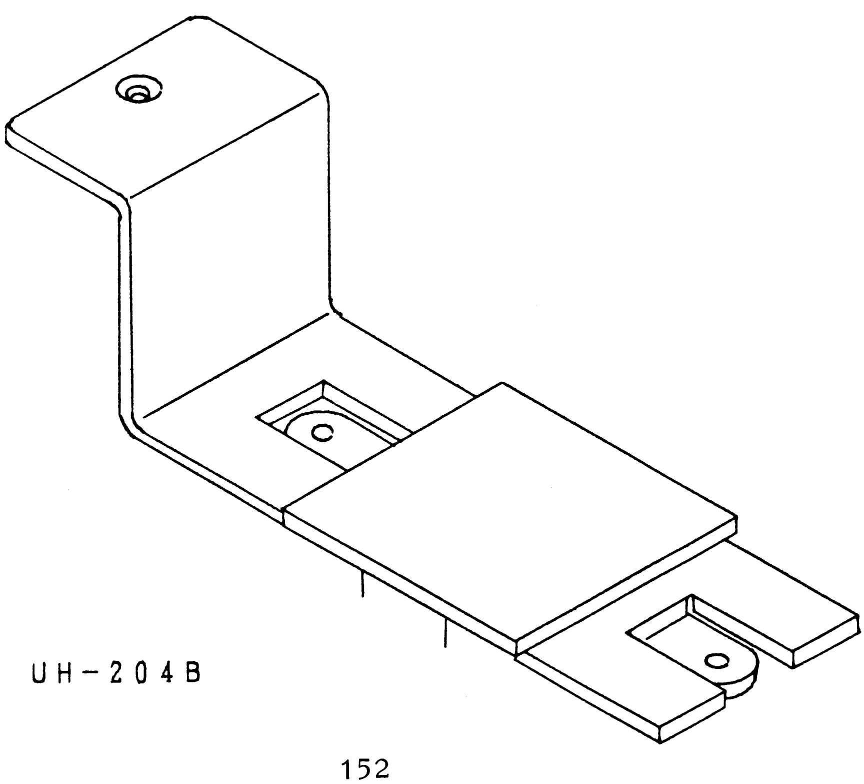


UN4213-(TA)



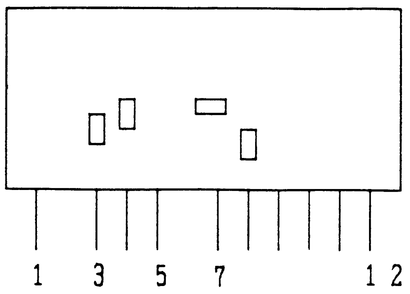
8PINS

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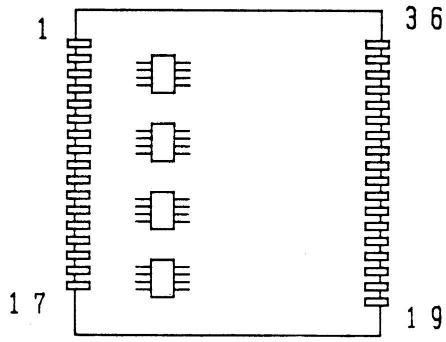


UH-204B

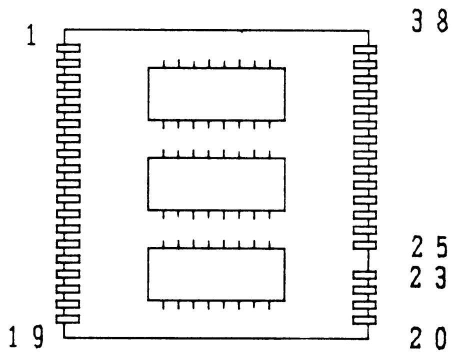
UH-201B



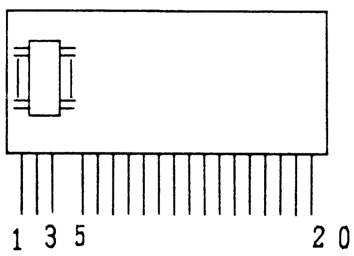
UH-202B



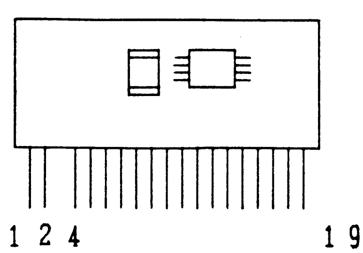
UH-203C



UH-207



UH-103



9. ELECTRICAL PARTS LIST
PEF-733 CH3, CH4 INPUT

Symbol	Part Code	Description	Q'ty
C 400	CCC1009	C, Ceramic 50V 27 pF ±5%	1
C 401	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C 404	CCD0275	C, Ceramic 500V 5 pF ±0.25pF	1
C 407	CCD0273	C, Ceramic 500V 2 pF ±0.25pF	1
C 409	CCD0286	C, Ceramic 500V 1000 pF +100 -0 %	1
C 410	CCC1002	C, Ceramic 50V 10 pF ±0.5pF	1
C 412	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 413	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 414	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 414A	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 415	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 421	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 422	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 425	CCC1003	C, Ceramic 50V 12 pF ±5%	1
C 431	CCG0185	C, Ceramic Chip 50V 10000 pF ±20%	1
C 450	CCG0140	C, Ceramic Chip 50V 56 pF ±5%	1
C 470	CCG0185	C, Ceramic Chip 50V 10000 pF ±20%	1
C 500	CCC1009	C, Ceramic Chip 50V 27 pF ±5%	1
C 501	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C 504	CCD0275	C, Ceramic 500V 5 pF ±0.25pF	1
C 507	CCD0273	C, Ceramic 500V 2 pF ±0.25pF	1
C 509	CCD0286	C, Ceramic 500V 1000 pF +100 -0 %	1
C 510	CCC1002	C, Ceramic 50V 10 pF ±0.5pF	1
C 512	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 513	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 514A	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 521	CCC1030	C, Ceramic 50V 10000 pF +80 -20 %	1
C 525	CCC1003	C, Ceramic 50V 12 pF ±5%	1
C 531	CCG0185	C, Ceramic Chip 50V 10000 pF ±20%	1
C 550	CCG0140	C, Ceramic Chip 50V 56 pF ±5%	1
C 570	CCG0185	C, Ceramic Chip 50V 10000 pF ±20%	1
CV 405	CVE0065	C, Variable ECR-HA007A41	1
CV 410	CVE0046	C, Variable ECR-HA010A11	1
CV 433	CVE0047	C, Variable ECR-HA020D11	1
CV 505	CVE0065	C, Variable ECR-HA007A41	1
CV 510	CVE0C46	C, Variable ECR-HA010A11	1
CV 533	CVE0047	C, Variable ECR-HA020D11	1
D 409	HDS0477	Diode 1SS110	1
D 509	HDS0477	Diode 1SS110	1
L 431	TLE0067	Inductor EL0606R-680K	1
P 400	JBB0021	Connector B3B-XH-A	1
P 440	JBB0021	Connector B3B-XH-A	1
P 450	JBB0022	Connector B6B-XH-A	1
P 500	JBB0C21	Connector B3B-XH-A	1
P 550	JBB0021	Connector B3B-XH-A	1

Symbol	Part Code	Description	Q'ty
R 400	RCE0748	R, Carbon 1/4W 18Ω ±5%	1
R 402	RMS0048	R, Metal 1/2W 800kΩ ±0.5%	1
R 402A	RCE0751	R, Carbon 1/4W 33Ω ±5%	1
R 403	RCE0754	R, Carbon 1/4W 56Ω ±5%	1
R 406	RME0912	R, Metal Chip Zero ohm Resistor	1
R 407	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 408	RMS0049	R, Metal 1/2W 1MΩ ±0.5%	1
R 409	RCE0733	R, Carbon 1/2W 470kΩ ±5%	1
R 410	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 411	RME1216	R, Metal 1/4W 250kΩ ±0.5%	1
R 412	RME1059	R, Metal 1/4W 82.5Ω ±1%	1
R 413	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 414	RME1059	R, Metal 1/4W 82.5Ω ±1%	1
R 415	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 416	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R 417	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 418	RCE0790	R, Carbon 1/4W 56kΩ ±5%	1
R 420	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 421	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 422	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 423	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 424	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 425	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 430	RCE0770	R, Carbon 1/4W 1.2kΩ ±5%	1
R 431	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
R 432	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 450	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 451	RME1057	R, Metal 1/4W 56.2Ω ±1%	1
R 452	RME1067	R, Metal 1/4W 392Ω ±1%	1
R 453	RME1246	R, Metal 1/4W 110Ω ±1%	1
R 454	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 470	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 500	RCE0748	R, Carbon 1/4W 18Ω ±5%	1
R 502	RMS0048	R, Metal 1/2W 800kΩ ±0.5%	1
R 502A	RCE0751	R, Carbon 1/4W 33Ω ±5%	1
R 503	RCE0754	R, Carbon 1/4W 56Ω ±5%	1
R 506	RME0912	R, Metal Chip Zero Ohm Resistor	1
R 507	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 508	RMS0049	R, Metal 1/2W 1MΩ ±0.5%	1
R 509	RCE0733	R, Carbon 1/2W 470kΩ ±5%	1
R 510	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 511	RME1216	R, Metal 1/4W 250kΩ ±0.5%	1
R 512	RME1059	R, Metal 1/4W 82.5Ω ±1%	1
R 513	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 514	RME1059	R, Metal 1/4W 82.5Ω ±1%	1
R 515	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 516	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R 517	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 518	RCE0790	R, Carbon 1/4W 56kΩ ±5%	1
R 520	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 521	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 522	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 523	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 524	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 525	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 530	RCE0770	R, Carbon 1/4W 1.2kΩ ±5%	1
R 531	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
R 532	RCE0749	R, Carbon 1/4W 22Ω ±5%	1

Symbol	Part Code	Description	Q'ty
R 550	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 551	RME1057	R, Metal 1/4W 56.2Ω ±1%	1
R 552	RME1067	R, Metal 1/4W 392Ω ±1%	1
R 553	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 554	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 570	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
RV 417	RNE0070	VR, Metal EVN39C00YB53(5K)	1
RV 433	RNE0049	VR, Metal EVN39C00YB12(100)	1
RV 434	RNE0048	VR, Metal EVN39C00YB22(200)	1
RV 470	8410400	RV, Carbon EVJ-KAAP20B14	1
RV 517	RNE0070	VR, Metal EVN39C00YB53(5K)	1
RV 533	RNE0049	VR, Metal EVN39C00YB12(100)	1
RV 534	RNE0048	VR, Metal EVN39C00YB22(200)	1
RV 570	8410400	RV, Carbon EVJ-KAAP20B14	1
S 400	8456533	SW, PB SUJ-20	1
S 500	8456533	SW, PB SUJ-20	1
TR 413A	HTK0063	Transistor 2SK152-3	1
TR 413B	HTK0063	Transistor 2SK152-3	1
TR 420	HTA0321	Transistor 2SA1424	1
TR 430	HTC0814	Transistor 2SC3355	1
TR 513A	HTK0063	Transistor 2SK152-3	1
TR 513B	HTK0063	Transistor 2SK152-3	1
TR 520	HTA0321	Transistor 2SA1424	1
TR 530	HTC0814	Transistor 2SC3355	1

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Symbol	Part Code	Description	Q'ty
C 11	CCD0286	C, Ceramic 500V 1000pF +100/-0%	1
C 12	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 13	CCG0141	C, Ceramic Chip 50V 68pF ±5%	1
C 14	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 17	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 19	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 20	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 25	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 28	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 29	CCG0122	C, Ceramic Chip 50V 8pF ±0.25pF	1
C 31	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 42	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 41	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 55	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 56	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1

Symbol	Part Code	Description	Q'ty
C 59	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 60	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 80	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 81	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 82	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 83	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 87	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 92	CCG0118	C, Ceramic Chip 50V 4pF ±0.25pF	1
C 100	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 101	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 102	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 104	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 125	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 126	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 130	CCG0136	C, Ceramic Chip 50V 33pF ±5%	1
C 140	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 141	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 150	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 151	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 152	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 153	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 211	CCD0286	C, Ceramic 500V 1000pF +100/-0%	1
C 212	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 213	CCG0141	C, Ceramic Chip 50V 68pF ±5%	1
C 214	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 217	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 219	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 220	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 225	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 228	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 229	CCG0122	C, Ceramic Chip 50V 8pF ±0.5pF	1
C 231	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 241	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 242	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
			1
C 255	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 256	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 257	CCG0116	C, Ceramic Chip 50V 2pF ±0.25pF	1
C 259	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 260	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 280	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 281	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 282	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 283	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 287	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 292	CCG0118	C, Ceramic Chip 50V 4pF ±0.25pF	1
C 300	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 301	CCG0211	C, Ceramic Chip 50V 1000pF ±10%	1
C 302	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 304	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 322	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 323	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 325	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 328	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 340	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 341	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1

Symbol	Part Code	Description	Q'ty
C 480	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 481	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 580	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 581	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 605	CCG0124	C, Ceramic Chip 50V 10pF ±0.5pF	1
C 607	CCG0119	C, Ceramic Chip 50V 5pF ±0.25pF	1
C 608	CCG0119	C, Ceramic Chip 50V 5pF ±0.25pF	1
C 650	CCG0121	C, Ceramic Chip 50V 7pF ±0.25pF	1
C 651	CCG0121	C, Ceramic Chip 50V 7pF ±0.25pF	1
C 2300	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2301	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2302	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2303	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2305	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2310	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2311	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2312	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2313	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2315	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2320	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2321	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2322A	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
C 2323A	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
C 2324A	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
C 2325A	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
C 2554	CCG0211	C, Ceramic Chip 50V 0.01μF ±10%	1
C 2700	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2701	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2702	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2703	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2708	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2711A	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2711B	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2712	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2720	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2721	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2722	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2723	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2728	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2732	CCG0205	C, Ceramic Chip 50V 1000pF ±10%	1
C 2735	CES0252	C, AL Elyc 16V 10μF ±20%BP	1
C 2736	CES0252	C, AL Elyc 16V 10μF ±20%BP	1
C 2856	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2866	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2886	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2887	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
CV 280	CVE0065	C, Variable ECR-HA070A11	1
D 14	HDS0477	Diode 1SS110	1
D 15	HDS0477	Diode 1SS110	1
D 16	HDS0477	Diode 1SS110	1
D 22	HDS0477	Diode 1SS110	1
D 214	HDS0477	Diode 1SS110	1
D 215	HDS0477	Diode 1SS110	1
D 216	HDS0477	Diode 1SS110	1
D 222	HDS0477	Diode 1SS110	1

Symbol	Part Code	Description	Q'ty
D 321	HDS0437	Diode 1SS133	1
D 2300	HDS0437	Diode 1SS133	1
D 2310	HDS0437	Diode 1SS133	1
IC 16	8397023A	IC, Analog LF411CN	1
IC 50	8457936	IC, Hybrid UH-201B	1
IC 80	8457936	IC, Hybrid UH-201B	1
IC 100	8457936	IC, Hybrid UH-201B	1
IC 150	8457937	IC, Hybrid UH-202B	1
IC 216	8397023A	IC, Analog LF411CN	1
IC 250	8457936	IC, Hybrid UH-201B	1
IC 380	8457936	IC, Hybrid UH-201B	1
IC 300	8457936	IC, Hybrid UH-201B	1
IC 2320	IDH0467	IC, Digital HD74LS00P	1
IC 2321	IDH0787	IC, Digital HD14015BP	1
IC 2322	ILU0010	IC, Analog UN4213	1
IC 2711	ILB0010	IC, Analog BA715	1
K 2300	SRR0053	Relay NR-HD-12V (AE5343)	1
K 2310	SRR0053	Relay NR-HD-12V (AE5343)	1
L 80	TLE0120	Inductor ELE-Y 6R8 KA	1
L 81	TLE0120	Inductor ELE-Y 6R8 KA	1
L 150	TLF0004	Coil FL-7H101K	1
L 152	TLE0120	Inductor ELE-Y 6R8 KA	1
L 280	TLE0120	Inductor ELE-Y 6R8 KA	1
L 281	TLE0120	Inductor ELE-Y 6R8 KA	1
L 650	TLL0221	Coil LQN2AR15K	1
L 651	TLL0221	Coil LQN2AR15K	1
L 1805	TLF0004	Coil FL-7H 101K	1
L 2300	TLE0120	Inductor ELE-Y 6R8 KA	1
L 2320	TLE0120	Inductor ELE-Y 6R8 KA	1
L 2322	TLE0058	Coil EL0606SK1 100K	1
L 2323	TLE0058	Coil EL0606SK1 100K	1
L 2324	TLE0058	Coil EL0606SK1 100K	1
L 2325	TLE0058	Coil EL0606SK1 100K	1
L 2551	TLE0120	Inductor ELE-Y 6R8 KA	1
P 100	JBB0021	Connector B3B-XH-A	1
P 200	JBB0027	Connector B2B-XH-A	1
P 300	JBB0021	Connector B3B-XH-A	1
P 441	JBB0021	Connector B3B-XH-A	1
P 451	JBB0022	Connector B6B-XH-A	1
P 551	JBB0021	Connector B3B-XH-A	1
P 600	JBB0023	Connector B8B-XH-A	1
P 701	JBX2088	Connector 164713-4 (8440219)	1
P 1501	JBX2097	Connector 2-164713-0 (8440219)	1
P 1510	JBB0022	Connector B6B-XH-A	1
P 1805	JBB0023	Connector B8B-XH-A	1
P 2010	JBS0037	Connector SLEM15S-2	1
P 2020	JBS0037	Connector SLEM15S-2	1
R 1	RCE0750	R, Carbon 1/4W 27Ω ±5%	1
R 3	RCE0751	R, Carbon 1/4W 33Ω ±5%	1
R 8	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 9	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 11	RSE0446	R, Solid 1/4W 22MΩ ±5%	1
R 12	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 13	RME0863	R, Metal Chip 1/8W 82Ω ±5%	1
R 14	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 15	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 16	RME0883	R, Metal Chip 1/8W 3.9kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R 17	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R 19	RME0886	R, Metal Chip 1/8W 6.8kΩ ±5%	1
R 20	RME0882	R, Metal Chip 1/8W 3.3kΩ ±5%	1
R 21	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 22	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 23	RME0859	R, Metal Chip 1/8W 39Ω ±5%	1
R 24	RME1283	R, Metal 1/4W 6.00kΩ ±0.5%	1
R 25	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 26	RME1081	R, Metal 1/4W 5.62kΩ ±1%	1
R 28	RME0899	R, Metal Chip 1/8W 82kΩ ±5%	1
R 29	RME0882	R, Metal Chip 1/8W 3.3kΩ ±5%	1
R 30	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 31	RME0859	R, Metal Chip 1/8W 39Ω ±5%	1
R 40	RME1056	R, Metal 1/4W 47.5Ω ±1%	1
R 41	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 42	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 50	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 51	RME1057	R, Metal 1/4W 56.2Ω ±1%	1
R 52	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 53	RME0858	R, Metal Chip 1/8W 33Ω ±5%	1
R 55	RME0858	R, Metal Chip 1/8W 33Ω ±5%	1
R 59	RME0900	R, Metal Chip 1/8W 100kΩ ±5%	1
R 60	RME1063	R, Metal 1/4W 182Ω ±1%	1
R 84	RME0863	R, Metal Chip 1/8W 82Ω ±5%	1
R 85	RME1068	R, Metal 1/4W 475Ω ±1%	1
R 86	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 87	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R 90	RME1057	R, Metal 1/4W 56.2Ω ±1%	1
R 91	RCE0754	R, Carbon 1/4W 56Ω ±5%	1
R 92	RME0867	R, Metal Chip 1/8W 180Ω ±5%	1
R 103	RME0864	R, Metal Chip 1/4W 100Ω ±1%	1
R 104	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 107	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 108	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 109	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 120	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 121	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 122	RME1112	R, Metal 1/4W 301Ω ±1%	1
R 123	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 124	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 125	RME0883	R, Metal Chip 1/8W 3.9kΩ ±5%	1
R 126	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 127	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 128	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 129	RME0885	R, Metal Chip 1/8W 5.6kΩ ±5%	1
R 130	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 131	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 140	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 141	RME0874	R, Metal Chip 1/8W 680Ω ±5%	1
R 142	RME0869	R, Metal Chip 1/8W 270Ω ±5%	1
R 143	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 187	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R 201	RCE0751	R, Carbon 1/4W 33Ω ±5%	1
R 203	RCE0751	R, Carbon 1/4W 33Ω ±5%	1
R 208	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 209	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 211	RSE0446	R, Solid 1/4W 22MΩ ±5%	1
R 212	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 213	RME0863	R, Metal Chip 1/8W 82Ω ±5%	1
R 214	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 215	RCE0765	R, Carbon 1/4W 470Ω ±5%	1

Symbol	Part Code	Description	Q'ty
R 216	RME0883	R, Metal Chip 1/8W 3.9kΩ ±5%	1
R 217	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R 219	RME0886	R, Metal Chip 1/8W 6.8kΩ ±5%	1
R 220	RME0882	R, Metal Chip 1/8W 3.3kΩ ±5%	1
R 221	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 222	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 223	RME0859	R, Metal Chip 1/8W 39Ω ±5%	1
R 224	RME1283	R, Metal 1/4W 6.00kΩ ±0.5%	1
R 225	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 226	RME1081	R, Metal 1/4W 5.62kΩ ±1%	1
R 228	RME0899	R, Metal Chip 1/8W 82kΩ ±5%	1
R 229	RME0822	R, Metal Chip 1/8W 3.3kΩ ±5%	1
R 230	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 231	RME0859	R, Metal Chip 1/8W 39Ω ±5%	1
R 240	RME1056	R, Metal 1/4W 47.5Ω ±1%	1
R 241	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 242	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 250	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 251	RME1057	R, Metal 1/4W 56.2Ω ±1%	1
R 252	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 253	RME0858	R, Metal Chip 1/8W 33Ω ±5%	1
R 255	RME0858	R, Metal Chip 1/8W 33Ω ±5%	1
R 259	RME0900	R, Metal Chip 1/8W 100kΩ ±5%	1
R 260	RME1063	R, Metal 1/4W 182Ω ±1%	1
R 284	RME0863	R, Metal Chip 1/8W 82Ω ±5%	1
R 285	RME1068	R, Metal 1/4W 475Ω ±1%	1
R 286	RME0860	R, Metal 1/8W 47Ω ±5%	1
R 290	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 292	RME0867	R, Metal Chip 1/8W 180Ω ±5%	1
R 243	RCE0755	R, Carbon 1/4W 68Ω ±5%	1
R 303	RME0864	R, Metal 1/4W 100Ω ±5%	1
R 304	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 307	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 308	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 320	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 321	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 323	RME0865	R, Metal Chip 1/8W 120Ω ±5%	1
R 324	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 325	RME0877	R, Metal Chip 1/8W 1.2kΩ ±5%	1
R 326	RME0862	R, Metal Chip 1/8W 68Ω ±5%	1
R 327	RME0869	R, Metal Chip 1/8W 270Ω ±5%	1
R 328	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 340	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 341	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 342	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 343	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 440A	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 441A	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
R 480	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 481	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 550A	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 551A	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
R 580	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 581	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 600	RME1058	R, Metal 1/4W 68.1Ω ±1%	1
R 601	RME1058	R, Metal 1/4W 68.1Ω ±1%	1
R 602	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 603	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 604	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 605	RME0871	R, Metal Chip 1/8W 390Ω ±5%	1
R 606	RME1068	R, Metal 1/4W 475Ω ±1%	1
R 2300	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 2302	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R 2303	RME0912	R, Metal Chip Zero Ohm Resistor	1
R 2303A	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 2310	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 2312	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2313	RME0912	R, Metal Chip Zero Ohm Resistor	1
R 2313A	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 2320	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 2322	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2322A	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 2323	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2323A	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 2324	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2324A	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 2325	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2325A	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 2513	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 2514	RME0912	R, Metal Zero Ohm Resistor	1
R 2515	RME1062	R, Metal 1/4W 150Ω ±1%	1
R 2546	RME1072	R, Metal 1/4W 100kΩ ±1%	1
R 2547	RME1072	R, Metal 1/4W 100kΩ ±1%	1
R 2550	RME1072	R, Metal 1/4W 100kΩ ±1%	1
R 2555	RME1098	R, Metal 1/4W 150kΩ ±1%	1
R 2556	RME1096	R, Metal 1/4W 100kΩ ±1%	1
R 2700	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R 2701	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 2702	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2703	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2704	RME1513	R, Metal Chip 1/8W 4.75kΩ ±1%	1
R 2705	RME1514	R, Metal Chip 1/8W 10kΩ ±1%	1
R 2706	RME1515	R, Metal Chip 1/8W 18kΩ ±1%	1
R 2707	RME1516	R, Metal Chip 1/8W 39kΩ ±1%	1
R 2708	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2709	RME1513	R, Metal Chip 1/8W 4.75kΩ ±1%	1
R 2711	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2711A	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2711B	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2712	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 2713	RME0885	R, Metal Chip 1/8W 5.6kΩ ±5%	1
R 2714	RME1064	R, Metal 1/4W 221Ω ±1%	1
R 2714A	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2720	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R 2721	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 2722	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2723	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2724	RME1513	R, Metal Chip 1/8W 4.75kΩ ±1%	1
R 2725	RME1514	R, Metal Chip 1/8W 10kΩ ±1%	1
R 2726	RME1515	R, Metal Chip 1/8W 18kΩ ±1%	1
R 2727	RME1516	R, Metal Chip 1/8W 39kΩ ±1%	1
R 2728	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2729	RME1513	R, Metal Chip 1/8W 4.75kΩ ±1%	1
R 2731	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2732	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 2733	RME1064	R, Metal 1/4W 221Ω ±1%	1
R 2733A	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2735	RME0885	R, Metal Chip 1/8W 5.6kΩ ±5%	1
R 2781	RME1087	R, Metal 1/4W 18.2kΩ ±1%	1
R 2782	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2783	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 2784	RME1243	R, Metal 1/4W 3.01kΩ ±1%	1
R 2785	RME1081	R, Metal 1/4W 5.62kΩ ±1%	1

Symbol	Part Code	Description	Q'ty
R 2786	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 2851	RME1087	R, Metal 1/4W 18.2kΩ ±1%	1
R 2852	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2853	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 2854	RME1243	R, Metal 1/4W 3.01kΩ ±1%	1
R 2855	RME1081	R, Metal 1/4W 5.62kΩ ±1%	1
R 2856	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 2863	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 2864	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 2865	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 2866	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 2883	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 2885	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
RM 40	3203299	R, Network For 2nd ATT	1
RM 240	3203299	R, Network For 2nd ATT	1
RV 26	RNE0058	VR, Metal EVN39C00YB13(1K)	1
RV 28	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 60	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 104	RNE0051	VR, Metal EVN39C00YB14(10K)	1
RV 125	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 140	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 226	RNE0058	VR, Metal EVN39C00YB13(1K)	1
RV 228	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 260	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 280	RNE0052	VR, Metal EVN39C00YB23(2K)	1
RV 290	RNE0049	VR, Metal EVN39C00YB12(100)	1
RV 304	RNE0051	VR, Metal EVN39C00YB14(10K)	1
RV 328	RNE0051	VR, Metal EVN39C00YB14(10K)	1
RV 340	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 480	RNE0053	VR, Metal EVN39C00YB24(20K)	1
RV 580	RNE0053	VR, Metal EVN39C00YB24(20K)	1
S 4	8457958	SW, Rotary ADR255C200B18R11PY02	1
S 204	8457958	SW, Rotary ADR255C200B18R11PY02	1
S 2850	8410389	SW, Rotary SRS-Type For Timing	1
TR 12	HTK0063	Transistor 2SK152-3	1
TR 20	HTC0557	Transistor 2SC1674K	1
TR 22	HTC0814	Transistor 2SC3355	1
TR 120	HTC0686	Transistor 2SC2462C	1
TR 121	HTC0686	Transistor 2SC2462C	1
TR 122	HTC0686	Transistor 2SC2462C	1
TR 212	HTK0063	Transistor 2SK152-3	1
TR 220	HTC0557	Transistor 2SC1674K	1
TR 222	HTC0814	Transistor 2SC3355	1
TR 320	HTC0819	Transistor 2SC3356R22	1
TR 2300	HTC0686	Transistor 2SC2462C	1
TR 2310	HTC0686	Transistor 2SC2462C	1
C 2330	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}\%$	1
D 2330	HDS0437	DIODE ISS133	1
D 2331	HDS0437	DIODE ISS133	1
D 2332	HDS0437	DIODE ISS133	1
D 2333	HDS0437	DIODE ISS133	1
D 2334	HDS0437	DIODE ISS133	1
D 2335	HDS0437	DIODE ISS133	1
D 2336	HDS0437	DIODE ISS133	1
IC 2331	ILU0010	IC, Digital UN4213	1

Symbol	Part Code	Description	Q'ty
C 2332	ILU0010	IC, Digital UN4213	1
R 2330	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2331	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2332	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2333	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2334	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
P 2330	JBS0037	Connector SLEM15S-2	1
P 2331	JBS0050	Connector SLEM15R-2	1

EF-735 DLY IN

Symbol	Part Code	Description	Q'ty
D 703	JBX2089	Connector 164711-4	1

EF-736 DLY OUT

Symbol	Part Code	Description	Q'ty
P 702	JBX2089	Connector 164711-4	1

EF-737 V-OUT

Symbol	Part Code	Description	Q'ty
C 701	CCC1133	C, Ceramic 50V 1 pF ±0.25pF	1
C 705	CCG0143	C, Ceramic Chip 50V 100 pF ±5%	1
C 705A	CCC1007	C, Ceramic 50V 22 pF ±5%	1
C 708	CCG0136	C, Ceramic Chip 50V 33 pF ±5%	1
C 709	CCG0144	C, Ceramic Chip 50V 220 pF ±5%	1
C 713	CCG0203	C, Ceramic Chip 50V 680 pF ±5%	1
C 718	CCG0203	C, Ceramic Chip 50V 680 pF ±5%	1
C 729	CCG0194	C, Ceramic Chip 50V 120 pF ±5%	1
C 730	CCG0194	C, Ceramic Chip 50V 120 pF ±5%	1
C 731	CCG0143	C, Ceramic Chip 50V 100 pF ±5%	1
C 732	CCG0124	C, Ceramic Chip 50V 10 pF ±5%	1
C 733	CCG0203	C, Ceramic Chip 50V 680 pF ±5%	1
C 734	CES0213	C, AL Elyc 16V 10 μF ±20%BP	1
C 741	CES0249	C, AL Elyc 50V 1 μF ±20%BP	1
C 735	CES0212	C, AL Elyc 10V 100 μF ±20%BP	1
C 742	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 743	CCG0205	C, Ceramic Chip 50V 1000 pF ±10%	1
C 748	CCG0205	C, Ceramic Chip 50V 1000 pF ±10%	1
C 751	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 760	CCC1030	C, Ceramic 50V 10000pF +80/-20%	1
C 765	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 766	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 767	CET0033	C, AL Elyc 160V 1 μF ±20%	1

Symbol	Part Code	Description	Q'ty
C 768	CCC1030	C, Ceramic 50V 10000 pF ±10%	1
C 780	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 781	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 782	CCC0997	C, Ceramic 50V 3 pF ±0.25pF	1
C 783	CCC0997	C, Ceramic 50V 3 pF ±0.25pF	1
C 855	CCG0139	C, Ceramic Chip 50V 47 pF ±5%	1
C 860	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 862	CCG0199	C, Ceramic Chip 50V 330 pF ±5%	1
C 872	CCG0205	C, Ceramic Chip 50V 1000 pF ±10%	1
C 873	CCG0134	C, Ceramic Chip 50V 27 pF ±5%	1
C 876	CCG0193	C, Ceramic Chip 50V 150 pF ±5%	1
C 882	CCG0211	C, Ceramic Chip 50V 10000 pF ±10%	1
C 883	CCG0211	C, Ceramic Chip 50V 10000 pF ±10%	1
C 887	CCG0211	C, Ceramic Chip 50V 10000 pF ±10%	1
C 888	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 889	CQE0050	C, Plastic ECQ-P1103JZ (100V 0.01MF)	1
C 890	CCG0211	C, Ceramic Chip 50V 10000 pF ±10%	1
C 893	CCD0287	C, Ceramic Chip 50V 4700 pF +100/-0%	1
C 894	CQA0122	C, Plastic 50V 47000 pF ±10%	1
C 895	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 896	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 897	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 898	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
C 899	CCG0213	C, Ceramic Chip 50V 0.1 μF +80/-20%	1
CV 708	CVE0047	C, Variable ECR-HA020D11	1
CV 731	CVE0046	C, Variable ECR-HA010A11	1
CV 732	CVE0047	C, Variable ECR-HA020D11	1
D 729	HDH0224	Diode HSM88S	1
D 730	HDH0224	Diode HSM88S	1
D 731	HDS0129	Diode 1S2268	1
D 765	HDH0219	Diode HZ15-L2	1
D 766	HDH0219	Diode HZ15-L2	1
D 781	HDS0437	Diode 1SS133	1
D 782	HDS0437	Diode 1SS133	1
D 801	HDX0055	Diode 1SS165	1
D 886	HDM0142	Diode MTZ 12JC	1
IC 760	8457939	IC, Hybrid UH-204B	1
IC 871	ILN0042	IC, Analog NJM 072S	1
IC 888	ILN0044	IC, Analog NJM2903S	1
IC 891	ILM0361	IC, Analog UPC398 (Sample & Hold)	1
J 769	8193940	Pin For Connector	1
J 770	8193940	Pin For Connector	1
L 763	8464407	Coil (2T.4T)	1
L 764	8464407	Coil (2T.4T)	1
L 805	TLE0138	Inductor ELE-Y 681 KA	1
L 859	TLE0067	Coil EL0606SK1 680K	1
L 876	TLE0076	Coil EL0606SK1 101K	1
P 700	JBX2088	Connector 164713-4 (8440219)	1
P 710	JBR0015	Connector RF-H202TD-1190	1
R 701	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 702	RCE0762	R, Carbon 1/4W 270Ω ±5%	1
R 703	RME1106	R, Metal 1/4W 75.0Ω ±1%	1

Symbol	Part Code	Description				Q'ty
R 704	RME1106	R, Metal	1/4W	75.0Ω	±1%	1
R 705	RME1070	R, Metal	1/4W	681Ω	±1%	1
R 705A	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 706	RME1056	R, Metal	1/4W	47.5Ω	±1%	1
R 708	RME0852	R, Metal Chip	1/8W	10Ω	±5%	1
R 709	RCE0770	R, Carbon	1/4W	1.2kΩ	±5%	1
R 710	RME1117	R, Metal	1/4W	750Ω	±1%	1
R 713	RME0856	R, Metal Chip	1/8W	22Ω	±5%	1
R 714	RME1117	R, Metal	1/4W	750Ω	±1%	1
R 715	RME1064	R, Metal	1/4W	221Ω	±1%	1
R 716	RME1064	R, Metal	1/4W	221Ω	±1%	1
R 717	RME1063	R, Metal	1/4W	182Ω	±1%	1
R 718	RME0856	R, Metal Chip	1/8W	22Ω	±5%	1
R 719	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R 720	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R 722	RCE0743	R, Carbon	1/4W	4.7Ω	±5%	1
R 723	RME1063	R, Metal	1/4W	182Ω	±1%	1
R 725	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 726	RME1064	R, Metal	1/4W	221Ω	±1%	1
R 727	RME1106	R, Metal	1/4W	75.0Ω	±1%	1
R 728	RME1106	R, Metal	1/4W	75.0Ω	±1%	1
R 729	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 730	RCE0759	R, Carbon	1/4W	150Ω	±5%	1
R 731	RME1057	R, Metal	1/4W	56.2Ω	±1%	1
R 732	RME0871	R, Metal Chip	1/8W	390Ω	±5%	1
R 733	RCE0778	R, Carbon	1/4W	5.6kΩ	±5%	1
R 734	RME0889	R, Metal Chip	1/8W	12kΩ	±5%	1
R 735	RME1389	R, Metal	1/4W	7.5kΩ	±5%	1
R 737	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 738	RME0850	R, Metal Chip	1/8W	4.7Ω	±5%	1
R 739	RME1061	R, Metal	1/4W	121Ω	±1%	1
R 740	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 741	RCE0780	R, Carbon	1/4W	8.2kΩ	±5%	1
R 742	RME1061	R, Metal	1/4W	121Ω	±1%	1
R 743	RME0857	R, Metal Chip	1/8W	27Ω	±5%	1
R 744	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 745	RME1059	R, Metal	1/4W	82.5Ω	±1%	1
R 746	RME1059	R, Metal	1/4W	82.5Ω	±1%	1
R 747	RME1117	R, Metal	1/4W	750Ω	±1%	1
R 748	RME0857	R, Metal Chip	1/8W	27Ω	±5%	1
R 749	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 750	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 751	RCE0743	R, Carbon	1/4W	4.7Ω	±5%	1
R 752	RCE0755	R, Carbon	1/4W	68Ω	±5%	1
R 753	RME1063	R, Metal	1/4W	182Ω	±1%	1
R 754	RME1063	R, Metal	1/4W	182Ω	±1%	1
R 755	RME1065	R, Metal	1/4W	267Ω	±1%	1
R 758	RME1065	R, Metal	1/4W	267Ω	±1%	1
R 759	RME0858	R, Metal Chip	1/8W	33Ω	±5%	1
R 760	RME0858	R, Metal Chip	1/8W	33Ω	±5%	1
R 761	RME1214	R, Metal	1/4W	50.0kΩ	±0.5%	1
R 762	RME1214	R, Metal	1/4W	50.0kΩ	±0.5%	1
R 763	RME0861	R, Metal Chip	1/8W	56Ω	±5%	1
R 764	RME0861	R, Metal Chip	1/8W	56Ω	±5%	1
R 765	RME0862	R, Metal Chip	1/8W	68Ω	±5%	1
R 766	RME0862	R, Metal Chip	1/8W	68Ω	±5%	1
R 767	RME0858	R, Metal Chip	1/8W	33Ω	±5%	1
R 768	RME0858	R, Metal Chip	1/8W	33Ω	±5%	1
R 769	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 770	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 771	RME1498	R, Metal	5W	220Ω	±2%	1
R 772	RME1498	R, Metal	5W	220Ω	±2%	1
R 773	RME1048	R, Metal	1/4W	10.0Ω	±1%	1

Symbol	Part Code	Description				Q'ty
R 774	RME1052	R, Metal	1/4W	22.1Ω	±1%	1
R 777	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 778	RME1117	R, Metal	1/4W	750Ω	±1%	1
R 780	RME0884	R, Metal Chip	1/8W	4.7kΩ	±5%	1
R 781	RME0868	R, Metal Chip	1/8W	220Ω	±5%	1
R 788	RCE0766	R, Carbon	1/4W	560Ω	±5%	1
R 789	RCE0765	R, Carbon	1/4W	470Ω	±5%	1
R 791	RCE0759	R, Carbon	1/4W	150Ω	±5%	1
R 792	RCE0759	R, Carbon	1/4W	150Ω	±5%	1
R 801	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 802	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 803	RCE0780	R, Carbon	1/4W	8.2kΩ	±5%	1
R 804	RCE0775	R, Carbon	1/4W	3.3kΩ	±5%	1
R 807	RCE0775	R, Carbon	1/4W	3.3kΩ	±5%	1
R 808	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 811	RME1059	R, Metal	1/4W	82.5Ω	±1%	1
R 812	RME1077	R, Metal	1/4W	2.67kΩ	±1%	1
R 813	RME1077	R, Metal	1/4W	2.67kΩ	±1%	1
R 814	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 816	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 821	RCE0785	R, Carbon	1/4W	22kΩ	±5%	1
R 822	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 823	RCE0779	R, Carbon	1/4W	6.8kΩ	±5%	1
R 851	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R 852	RCE0758	R, Carbon	1/4W	120Ω	±5%	1
R 853	RCE0759	R, Carbon	1/4W	150Ω	±5%	1
R 854	RME1077	R, Metal	1/4W	2.67kΩ	±1%	1
R 858	RME1067	R, Metal	1/4W	392Ω	±1%	1
R 859	RME1078	R, Metal	1/4W	3.32kΩ	±1%	1
R 860	RCE0787	R, Carbon	1/4W	33kΩ	±5%	1
R 862	RME1078	R, Metal	1/4W	3.32kΩ	±1%	1
R 863	RME1073	R, Metal	1/4W	1.21kΩ	±1%	1
R 864	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 865	RCE0754	R, Carbon	1/4W	56Ω	±5%	1
R 868	RME1060	R, Metal	1/4W	100Ω	±1%	1
R 869	RME1060	R, Metal	1/4W	100Ω	±1%	1
R 871	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 872	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 873	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 874	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 876	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 877	RCE0771	R, Carbon	1/4W	1.5kΩ	±5%	1
R 881	RME1212	R, Metal	1/4W	20.0kΩ	±0.5%	1
R 882	RME1212	R, Metal	1/4W	20.0kΩ	±0.5%	1
R 883	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 884	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 885	RCE0797	R, Carbon	1/4W	220kΩ	±5%	1
R 886	RCE0797	R, Carbon	1/4W	220kΩ	±5%	1
R 887	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 888	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 889	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 890	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 891	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 892	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 893	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 894	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 895	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 896	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
RT 707	HDE0058	Thermistor	ERT-D2ZHK332S			1
RT 789	8360511	Thermistor	TMD 1410H			1
RT 789A	8360511	Thermistor	TMD 1410H			1

Symbol	Part Code	Description		Q'ty
RV 708	RNE0049	VR, Metal	EVN 39C00YB12(100)	1
RV 709	RNE0070	VR, Metal	EVN 39C00YB53(5K)	1
RV 711	RNE0048	VR, Metal	EVN 39C00YB22(200)	1
RV 726	RNE0048	VR, Metal	EVN 39C00YB22(200)	1
RV 865	RNE0048	VR, Metal	EVN 39C00YB22(200)	1
RV 874	RNE0053	VR, Metal	EVN 39C00YB24(20K)	1
RV 892	RNE0054	VR, Metal	EVN 39C00YB15(100K)	1
TR 703	HTC0806	Transistor	2SC2351R3	1
TR 704	HTC0806	Transistor	2SC2351R3	1
TR 721	HTA0318	Transistor	2SA1462Y34	1
TR 724	HTA0318	Transistor	2SA1462Y34	1
TR 737	HTC0806	Transistor	2SC2351R3	1
TR 740	HTC0806	Transistor	2SC2351R3	1
TR 745	HTC0806	Transistor	2SC2351R3	1
TR 746	HTC0806	Transistor	2SC2351R3	1
TR 804	HTN0116	Transistor	NTM2369	1
TR 807	HTC0691	Transistor	2SC2735	1
TR 808	HTC0691	Transistor	2SC2735	1
TR 814	HTN0116	Transistor	NTM2369	1
TR 821	HTN0116	Transistor	NTM2369	1
TR 852	HTC0686	Transistor	2SC2462C	1
TR 855	HTC0686	Transistor	2SC2462C	1
TR 860	HTC0686	Transistor	2SC2462C	1
TR 862	HTC0686	Transistor	2SC2462C	1
TR 864	HTC0691	Transistor	2SC2735	1
TR 865	HTC0691	Transistor	2SC2735	1
R 783	RZZ0052	R fusing	RF50S 1Ω	1
R 855	RME1075	R,Metal	1/4W 1.82k	1

EF-738 TRIG & HV

Symbol	Part Code	Description				Q'ty
C 901	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 902	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 903	CQA0099	C, Plastic	50V	22000 pF	±10%	1
C 905	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 907	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	R
C 908	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 909	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 911	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 914	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 915	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1
C 916	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1
C 919	CCC1005	C, Ceramic	50V	18 pF	±5%	1
C 920	CES0252	C, AL Elyc	16V	10 µF	±20%BP	1
C 921	CCC1005	C, Ceramic	50V	18 pF	±5%	1
C 922	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 923	CQA0099	C, Plastic	50V	22000 pF	±10%	1
C 925	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1
C 926	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1

Symbol	Part Code	Description				Q'ty
C 927	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1
C 1001	CCC1036	C, Ceramic	50V	22000pF	±10%	1
C 1004	CES0249	C, AL Elyc	50V	1 µF	±20%BP	1
C 1010	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	R
C 1011	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1012	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1130	CQA0099	C, Plastic	50V	22000 pF	±10%	1
C 1105	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1107	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1108	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1111	CEX0230	C, AL Elyc	50V	1 µF	BP	1
C 1112	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 1113	CES0133	C, AL Elyc	16V	47047µF	±20%	1
C 1114	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1201	CCC1036	C, Ceramic	50V	22000pF	±10%	1
C 1521	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1522	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1523	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1524	CQA0124	C, Plastic	50V	0.1 µF	±10%	1
C 1525	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1526	CCC1356	C, Ceramic	50V	470 pF	±10%	1
C 1527	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1529	CCC1160	C, Ceramic	50V	330 pF	±10%	1
C 1530	CCC1160	C, Ceramic	50V	330 pF	±10%	1
C 1531	CQA0101	C, Plastic	50V	47000 pF	±10%	1
C 1532	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 1533	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 1534	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 1535	CET0033	C, AL Elyc	160V	1 µF	±20%	1
C 1536	CET0033	C, AL Elyc	160V	1 µF	±20%	1
C 1537	CES0133	C, AL Elyc	16V	47 µF	±20%	1
C 1540	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1541	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1542	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1543	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1721	CCC1007	C, Ceramic	50V	22 pF	±5%	1
C 1726	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1731	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1732	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1733	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1734	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1736	CCC1011	C, Ceramic	50V	33pF	±5%	1
C 1741	CCD0272	C, Ceramic	500V	1 pF	±0.25pF	1
C 1742	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1743	CCC1030	C, Ceramic	50V	10000 pF	+80/-20%	1
C 1744	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1745	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1746	CCD0287	C, Ceramic	500V	4700 pF	+100/-0%	1
C 1747	CES0053	C, AL Elyc	160V	1 µF	±20%	1
C 1761	CES0035	C, AL Elyc	50V	47 µF	±20%	1
C 1762	CQA0122	C, Plastic	50V	47000 pF	±10%	1
C 1764	CCC1182	C, Ceramic	50V	1000 pF	±10%	1
C 1765	CET0033	C, AL Elyc	160V	1 µF	±20%	1
C 1767	CQA0122	C, Plastic	50V	47000 pF	±10%	1
C 1769	CQA0122	C, Plastic	50V	47000 pF	±10%	1
C 1770	CCD0246	C, Ceramic	2kV	1000 pF	±10%	1
C 1771	CCD0231	C, Ceramic	2000V	4700 pF	+80/-20%	1
C 1772	CCD0231	C, Ceramic	2000V	4700 pF	+80/-20%	1
C 1773	CCD0231	C, Ceramic	2000V	4700 pF	+80/-20%	1
C 1774	CCD0231	C, Ceramic	2000V	4700 pF	+80/-20%	1
C 1104	CES0133	C, AL Elyc	16V	47µF	±20%	1

Symbol	Part Code	Description				Q'ty
C 1775	CCD0282	C, Ceramic	500V	47 pF	±5%	1
C 1777	CCD0246	C, Ceramic	2kV	1000 pF	±10%	1
C 1778	CCD0231	C, Ceramic	2000V	4700 pF	$^{+80}_{-20}\%$	1
C 1779	CET0033	C, AL Elyc	160V	1 μF	±20%	1
C 1780	CCD0231	C, Ceramic	2000V	4700 pF	$^{+80}_{-20}\%$	1
C 1781	CCC0996	C, Ceramic	50V	2 pF	±0.25pF	1
C 1783	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 1784	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 1785	CCD0231	C, Ceramic	2000V	4700 pF	$^{+80}_{-20}\%$	1
C 1786	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 1787	CCD0231	C, Ceramic	2000V	4700 pF	$^{+80}_{-20}\%$	1
C 1796	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2401	CES0133	C, AL Elyc	16V	47 μF	±20%	1
C 2404	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2405	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2406	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2407	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2408	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2409	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2410	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2411	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2412	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2415	CCC1030	C, Ceramic	50V	10000 pF	$^{+80}_{-20}\%$	1
C 2452	CCC1182	C, Ceramic	50V	1000 pF	±10%	1
C 2461	CCC1011	C, Ceramic	50V	33 pF	±5%	1
C 2465	CCC1011	C, Ceramic	50V	33 pF	±5%	1
CL 1532	AFD0010	Fil	DST310-55D223S			1
CL 1533	AFD0010	Fil	DST310-55D223S			1
CL 1534	AFD0010	Fil	DST310-55D223S			1
CL 1535	AFD0010	Fil	DST310-55D223S			1
CL 1537	AFD0010	Fil	DST310-55D223S			1
CL 2401	AFD0010	Fil	DST310-55D223S			1
D 1724	HDM0139	Diode	MTZ3.3JA			
D 903	HDS0437	Diode	1SS133			1
D 905	HDS0437	Diode	1SS133			1
D 906	HDS0437	Diode	1SS133			1
D 907	HDS0437	Diode	1SS133			1
D 908	HDS0437	Diode	1SS133			1
D 1001	HDS0437	Diode	1SS133			1
D 1002	HDS0437	Diode	1SS133			1
D 1003	HDS0437	Diode	1SS133			1
D 1004	HDS0437	Diode	1SS133			1
D 1005	HDS0437	Diode	1SS133			1
D 1525	HDS0437	Diode	1SS133			1
D 1526	HDS0437	Diode	1SS133			1
D 1721	HDS0437	Diode	1SS133			1
D 1734	HDS0437	Diode	1SS133			1
D 1735	HDX0055	Diode	1SS165			1
D 1737	HDS0437	Diode	1SS133			1
D 1740	HDH0192	Diode	HZS6.8EB3			1
D 1747	HDS0437	Diode	1SS133			1
D 1771	HDY0031	Diode	Y10GA			1
D 1772	HDY0031	Diode	Y10GA			1
D 1773	HDS0477	Diode	1SS110			1
D 1775	HDS0250	Diode	1SS83			1
D 1776	HDS0250	Diode	1SS83			1
D 1777	HDS0250	Diode	1SS83			1
D 1778	HDS0250	Diode	1SS83			1
D 1779	HDH0126	Diode	Zener HZ-15-2			1
D 1780	HDS0437	Diode	1SS133			1
D 2401	HDS0437	Diode	1SS133			1
D 2402	HDS0437	Diode	1SS133			1

Symbol	Part Code	Description		Q'ty
F 1761	EFZ0C14	IC Protect	ICP-F25 (1A)	1
IC 901	8457941	IC, Hybrid	UH-207	1
IC 903	ILN0042	IC, Analog	NJM 072S	1
IC 905	IDH0800	IC, Digital	HD14051BP	1
IC 907	ILB0010	IC, Analog	BA715	1
IC 911	IDH0467	IC, Digital	HD74LS00P	1
IC 1001	8457938	IC, Hybrid	UH-203C	1
IC 1002	ILN0044	IC, Analog	NJM2903S	1
IC 1003	ILN0060	IC, Analog	NJM311D	1
IC 1005	ILU0010	IC, Analog	UN4213	1
IC 1006	ILU0010	IC, Analog	UN4213	1
IC 1101	8457941	IC, Hybrid	UH-207	1
IC 1102	ILN0042	IC, Analog	NJM 072S	1
IC 1103	IDH0802	IC, Digital	HD14053BP	1
IC 1201	IDM0572	IC, Digital	MC10H102L	1
IC 1521	8457942	IC, Analog	BM1202A	1
IC 1522	IDH0581	IC, Digital	HD74LS175P	1
IC 1523	IDH0581	IC, Digital	HD74LS175P	1
IC 1524	IDH0923	IC, Digital	HN482764G-4	1
IC 1525	IDH0467	IC, Digital	HD74LS00P	1
IC 1526	IDH0646	IC, Digital	HD74LS02P	1
IC 2340	IDM0580	IC, Digital	M57902L	1
IC 2341	IDM0580	IC, Digital	M57902L	1
IC 2342	ILU0010	IC, Analog	UN4213	1
IC 2401	IDH0008	IC, Digital	HD10131	1
IC 2402	IDM0577	IC, Digital	MC10H131L	1
IC 2403	IDH0008	IC, Digital	HD10131	1
IC 2404	IDH0812	IC, Digital	HD14518BP	1
IC 2405	IDT0051	IC, Digital	TC40H390P	1
IC 2406	IDT0149	IC, Digital	TC40H153P	1
IC 2407	IDH0823	IC, Digital	HD74LS293P	1
IC 2408	IDT0039	IC, Digital	TC40H000P	1
IC 2409	IDH0795	IC, Digital	HD14040BP	1
IC 2410	IDH0786	IC, Digital	HD14014BP	1
IC 2411	IDH0786	IC, Digital	HD14014BP	1
IC 2412	IDH0786	IC, Digital	HD14014BP	1
IC 2413	IDM0573	IC, Digital	MC10H104L	1
IC 2415	IDH0812	IC, Digital	HD14518BP	1
IC 2416	IDH0003	IC, Analog	HD10104	1
IC 2418	ILU0010	IC, Analog	UN4213	1
IC 2419	ILU0010	IC, Analog	UN4213	1
IC 2417	ILU0010	IC, Analog	UN4213	1
K 906	SRR0053	Relay	NR-HD-12V(AE5343)	1
L 901	TLE0089	Coil	EL0606SKI 6R8K	1
L 926	TLE0072	Coil	EL0606SK1 221K	1
L 1206	TLE0120	Inductor	ELE-Y6R8KA	1
L 1761	TLF0004	Inductor	FL-7H 101K	1
L 1765	TLE0072	Coil	EL0606SK1 221K	1
L 1781	TLE0138	Inductor	ELE-Y 681 KA	1
MUT1771	3184284	Multiplier	For V-1100,V-1070	1
NL 1776	ELS0032	Lamp	SA-200DSS-ON-1	1
P 120	JBB0022	Connector	B6B-XH-A	1
P 411	JBB0022	Connector	B6B-XH-A	1
P 711	JBR0015	Connector	RF-H202TD-1190	1
P 1391	JBS0051	Connector	SLEM19S-2	1
P 1701	JBB0022	Connector	B6B-XH-A	1
P 1703	JBB0021	Connector	B3B-XH-A	1
P 1707	JBB0021	Connector	B3B-XH-A	1

Symbol	Part Code	Description				Q'ty
P 1709	JBB0027	Connector	B2B-XH-A			1
P 1841	JBB0058	Connector	B12B-XH-A			1
P 2030	JBS0053	Connector	SLEM21S-2			1
P 2040	JBS0053	Connector	SLEM21S-2			1
P 2307	JBB0021	Connector	B3B-XH-A			1
P 2701	JBB0028	Connector	B4B-XH-A			1
P 2703	JBB0027	Connector	B2B-XH-A			1
R 901	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 902	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 903	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 904	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 905	RCE0785	R, Carbon	1/4W	22kΩ	±5%	1
R 906	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 907	RME1080	R, Metal	1/4W	4.75kΩ	±1%	1
R 910	RCE0770	R, Carbon	1/4W	1.2kΩ	±5%	1
R 917	RME1080	R, Metal	1/4W	4.75kΩ	±1%	1
R 918	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 919	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 920	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 921	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 922	RME1073	R, Metal	1/4W	1.21kΩ	±1%	1
R 923	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 924	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 925	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 926	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 928	RME1157	R, Metal	1/4W	16.0kΩ	±0.5%	1
R 930	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 931	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 932	RCE0762	R, Carbon	1/4W	270Ω	±5%	1
R 933	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 936	RCE0784	R, Carbon	1/4W	18kΩ	±5%	1
R 937	RCE0784	R, Carbon	1/4W	18kΩ	±5%	1
R 938	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 939	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 940	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 941	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 942	RCE0792	R, Carbon	1/4W	82kΩ	±5%	1
R 943	RCE0786	R, Carbon	1/4W	27kΩ	±5%	1
R 944	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 945	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 946	RCE0786	R, Carbon	1/4W	27kΩ	±5%	1
R 947	RCE0792	R, Carbon	1/4W	82kΩ	±5%	1
R 949	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 951	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 952	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 955	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 956	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 957	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 958	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 959	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 960	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 961	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 963	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 964	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 965	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 967	RCE0804	R, Carbon	1/4W	75Ω	±5%	1
R 972	RCE0792	R, Carbon	1/4W	82kΩ	±5%	1
R 973	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R 974	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 975	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 976	RCE0775	R, Carbon	1/4W	3.3kΩ	±5%	1
R 977	RCE0785	R, Carbon	1/4W	22kΩ	±5%	1

Symbol	Part Code	Description				Q'ty
R 979	RME1148	R, Metal	1/4W	90.0Ω	±0.5%	1
R 980	RME1148	R, Metal	1/4W	90.0Ω	±0.5%	1
R 981	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 982	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 984	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 987	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 988	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 989	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 990	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 991	RCE0766	R, Carbon	1/4W	560Ω	±5%	1
R 993	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 994	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 1001	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 1002	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R 1004	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 1005	RCE0775	R, Carbon	1/4W	3.3kΩ	±5%	1
R 1006	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 1007	RCE0833	R, Carbon	1/4W	240kΩ	±5%	1
R 1008	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 1009	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 1010	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 1013	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 1014	RCE0779	R, Carbon	1/4W	6.8kΩ	±5%	1
R 1015	RCE0779	R, Carbon	1/4W	6.8kΩ	±5%	1
R 1016	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 1017	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R 1018	RCE0774	R, Carbon	1/4W	2.7kΩ	±5%	1
R 1019	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 1020	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 1021	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 1022	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 1023	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 1024	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 1025	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 1026	RCE0797	R, Carbon	1/4W	220kΩ	±5%	1
R 1027	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 1028	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 1029	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 1101	RCE0770	R, Carbon	1/4W	1.2kΩ	±5%	1
R 1107	RME1080	R, Metal	1/4W	4.75kΩ	±1%	1
R 1108	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 1110	RME1157	R, Metal	1/4W	16.0kΩ	±0.5%	1
R 1115	RME1066	R, Metal	1/4W	332Ω	±1%	1
R 1118	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 1120	RME1073	R, Metal	1/4W	1.21kΩ	±1%	1
R 1121	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 1122	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 1124	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 1125	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 1126	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 1127	RME1080	R, Metal	1/4W	4.75kΩ	±1%	1
R 1201	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 1202	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R 1204	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 1206	RCE0769	R, Carbon	1/4W	1kΩ	±5%	1
R 1209	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 1521	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R 1524	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R 1527	RCE0774	R, Carbon	1/4W	2.7kΩ	±5%	1
R 1528	RCE0778	R, Carbon	1/4W	5.6kΩ	±5%	1
R 1529	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 1530	RCE0798	R, Carbon	1/4W	330kΩ	±5%	1
R 1531	RME1085	R, Metal	1/4W	12.1kΩ	±1%	1
R 1532	RME1260	R, Metal	1/4W	35.7kΩ	±1%	1

Symbol	Part Code	Description	Q'ty
R 1533	RME1260	R, Metal 1/4W 35.7kΩ ±1%	1
R 1534	RME1260	R, Metal 1/4W 35.7kΩ ±1%	1
R 1535	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1538	RCE0774	R, Carbon 1/4W 2.7kΩ ±5%	1
R 1539	RCE0774	R, Carbon 1/4W 2.7kΩ ±5%	1
R 1540	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1541	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1542	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1543	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1544	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1545	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1546	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1548	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1549	RCE0774	R, Carbon 1/4W 2.7kΩ ±5%	1
R 1550	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1551	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1552	RCE0782	R, Carbon 1/4W 12kΩ ±5%	1
R 1553	RCE0782	R, Carbon 1/4W 12kΩ ±5%	1
R 1554	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1556	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1559	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1560	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1721	RCE0782	R, Carbon 1/4W 12kΩ ±5%	1
R 1722	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1723	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 1725	RCE0787	R, Carbon 1/4W 33kΩ ±5%	1
R 1726	RCE0783	R, Carbon 1/4W 15kΩ ±5%	1
R 1728	RME1084	R, Metal 1/4W 10.0kΩ ±0.5%	1
R 1731	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1733	RME1087	R, Metal 1/4W 18.2kΩ ±1%	1
R 1734	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1735	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1736	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1739	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1740	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1741	RME1369	R, Metal 1W 15kΩ ±5%	1
R 1742	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1743	RCE0788	R, Carbon 1/4W 39kΩ ±5%	1
R 1744	RCE0782	R, Carbon 1/4W 12kΩ ±5%	1
R 1745	RZR0001	R, Fusing 1/4W 1.0kΩ ±0.5%	1
R 1747	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1756	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1761	RCE0760	R, Carbon 1/4W 180Ω ±5%	1
R 1762	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1763	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1765	RME0722	R, Metal 1/4W 392kΩ ±1%	1
R 1766	RME1097	R, Metal 1/4W 121kΩ ±1%	1
R 1767	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1769	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1770	RMV0004	R, Metal 1/2W 22.1MΩ ±1%	1
R 1771	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1772	RCE0715	R, Carbon 1/2W 6.8kΩ ±5%	1
R 1775	RMV0010	R, Metal VR37 2.2MΩ ±5%	1
R 1776	RSE0434	R, Solid 1/4W 10MΩ ±5%	1
R 1777	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1778	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1779	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1780	RME1221	R, Metal 1/4W 1.37kΩ ±1%	1
R 1781	RME1221	R, Metal 1/4W 1.37kΩ ±1%	1
R 1782	RME1119	R, Metal 1/4W 1.15kΩ ±1%	1
R 1783	RME1117	R, Metal 1/4W 750Ω ±1%	1

Symbol	Part Code	Description	Q'ty
R 1784	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R 1786	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 1787	RCE0715	R, Carbon 1/2W 6.8kΩ ±5%	1
R 1788	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1789	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1790	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R 1791	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R 1792	RCE0799	R, Carbon 1/4W 390kΩ ±5%	1
R 1793	RMV0005	R, Metal 1/2W 10MΩ ±5%	1
R 1794	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R 1795	RCE0735	R, Carbon 1/2W 1.0MΩ ±5%	1
R 1796	RME1221	R, Metal 1/4W 1.37kΩ ±1%	1
R 1797	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 1798	RME1174	R, Metal 1/4W 2.00kΩ ±1%	1
R 2340	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 2341	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2401	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2402	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2403	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2405	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2406	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2407	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2408	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2410	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 2411	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 2412	RCE0782	R, Carbon 1/4W 12kΩ ±5%	1
R 2413	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2414	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2415	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2416	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2417	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2418	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 2419	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2420	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 2421	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2422	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2423	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 2424	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2425	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2426	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 2427	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2428	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2429	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2430	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2431	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2432	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2433	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 2437	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R 2438	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2439	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2440	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2443	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2444	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2445	RCE0787	R, Carbon 1/4W 33kΩ ±5%	1
R 2446	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2447	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2448	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 2449	RCE0787	R, Carbon 1/4W 33kΩ ±5%	1
R 2451	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2452	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 2454	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2455	RCE0766	R, Carbon 1/4W 560Ω ±5%	1
R 2456	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	

Symbol	Part Code	Description				Q'ty
R 2457	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 2459	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 2460	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 2461	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 2462	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 2463	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 2465	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R 2464	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
RV 902	RNE0053	VR, Metal	EVN 39C00YB24(20K)			1
RV 903	RNE0081	RV, Metal	0.5W 2MΩ			1
RV 904	RNE0081	RV, Metal	0.5W 2MΩ			
RV 1101	RNE0053	VR, Metal	EVN 39C00YB24(20K)			1
RV 1730	RNE0054	VR, Metal	EVN 39C00YB15(100K)			1
RV 1731	RNE0054	VR, Metal	EVN 39C00YB15(100K)			1
RV 1779	RNE0047	VR, Metal	EVN 39C00YB54(50K)			1
T 1761	3184280		For V-1100,V-1070			1
TR 901	HTC0400	Transistor	2SC2026			1
TR 902	HTA0290	Transistor	2SA1206			1
TR 903	HTA0290	Transistor	2SA1206			1
TR 904	HTC0400	Transistor	2SC2026			1
TR 905	HTA0224	Transistor	2SA1029 D			1
TR 906	HTC0148	Transistor	2SC458-C-			1
TR 908	HTC0400	Transistor	2SC2026			1
TR 909	HTA0290	Transistor	2SA1206			1
TR 910	HTC0192	Transistor	2SC641K-C			1
TR 1001	HTC0192	Transistor	2SC641K-C			1
TR 1002	HTA0224	Transistor	2SA1029 D			1
TR 1521	HTA0224	Transistor	2SA1029 D			1
TR 1522	HTA0224	Transistor	2SA1029 D			1
TR 1523	HTA0224	Transistor	2SA1029 D			1
TR 1524	HTA0224	Transistor	2SA1029 D			1
TR 1525	HTA0224	Transistor	2SA1029 D			1
TR 1526	HTA0224	Transistor	2SA1029 D			1
TR 1527	HTA0224	Transistor	2SA1029 D			1
TR 1728	HTC0192	Transistor	2SC641K-C			1
TR 1740	HTC0338	Transistor	2SC1906			1
TR 1746	HTC0669	Transistor	2SC2912S			1
TR 1747	HTA0258	Transistor	2SA1210S			1
TR 1761	HTD0145	Transistor	2SD1267AP			1
TR 1762	HTA0224	Transistor	2SA1029 D			1
TR 1767	HTK0099	Transistor	2SK404E			1
TR 1768	HTC0148	Transistor	2SC458-C-			1
TR 1780	HTA0224	Transistor	2SA1029 D			1
TR 1781	HTA0104	Transistor	2SA778A K			1
TR 1782	HTC0669	Transistor	2SC2912S			1
TR 2401	HTA0224	Transistor	2SA1029 D			1
TR 2402	HTA0224	Transistor	2SA1029 D			1
TR 2403	HTA0224	Transistor	2SA1029 D			1
TR 2404	HTA0224	Transistor	2SA1029 D			1
TR 2405	HTA0224	Transistor	2SA1029 D			1
TR 2406	HTA0224	Transistor	2SA1029 D			1
TR 2407	HTA0290	Transistor	2SA1206			1
TR 2408	HTA0290	Transistor	2SA1206			1
TR 2409	HTC0148	Transistor	2SC458-C-			1

Symbol	Part Code	Description				Q'ty
C 1005	CCC1025	C, Ceramic	50V	100pF	±10%	1
C 1251	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1254	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1255	CCC1002	C, Ceramic	50V	10pF	±5%	1
C 1256	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1259	CCC1025	C, Ceramic	50V	100pF	±10%	1
C 1260	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1261	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1305	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1314	CCC1011	C, Ceramic	50V	33pF	±5%	1
C 1315	CCC1034	C, Ceramic	50V	68pF	±5%	1
C 1316	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1318	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1319	CCC1004	C, Ceramic	50V	15pF	±5%	1
C 1321	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1325	CQE0078	C, Plastic	ECQ-E1225JN(JNB) Type-1			1
C 1326	CQE0107	C, Plastic	ECQ-K1223GZ (100V 0.022μF)			1
C 1327	CMV0053	C, Mica	50V	180pF	±5%	1
C 1328	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1329	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1331	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1332	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1333	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1334	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1335	CQA0131	C, Plastic	50V	0.22μF	±10%	1
C 1336	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1342	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	R
C 1343	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	R
C 1350	CCC1004	C, Ceramic	50V	15pF	±5%	1
C 1356	CCC1025	C, Ceramic	50V	100pF	±10%	1
C 1358	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1359	CES0226FY	C, AL Elyc	50V	3.3μF	±20%	1
C 1360	CQA0124	C, Plastic	50V	0.1μF	±10%	1
C 1361	CQA0127	C, Plastic	50V	10000pF	±10%	1
C 1362	CEX0230	C, AL Elyc	50V	1μF	BP	1
C 1363	CQA0127	C, Plastic	50V	10000pF	±10%	1
C 1364	CCC1004	C, Ceramic	50V	15pF	±5%	1
C 1380	CET0033	C, AL Elyc	160V	1μF	±20%	1
C 1381	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1382	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1383	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1405	CCC1030	C, Ceramic	50V	1000C pF	+80 -20%	1
C 1414	CCC1011	C, Ceramic	50V	33pF	±5%	1
CV 1414	CVE0046	C, Variable	ECR-HA010A11			1
C 1415	CCC1034	C, Ceramic	50V	68pF	±5%	1
C 1416	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1418	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1419	CCC1004	C, Ceramic	50V	15pF	±5%	1
C 1420	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1421	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1422	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1425	CQE0078	C, Plastic	ECQ-E1225JN (JNB) Type-1			1
C 1426	CQE0107	C, Plastic	ECQ-K1223GZ (100V 0.022μF)			1
C 1427	CMV0053	C, Mica	50V	180pF	±5%	1
C 1429	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	1
C 1430	CQA0112	C, Plastic	50V	0.47μF	±10%	R
C 1433	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1436	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 1442	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	R
C 1443	CCC1030	C, Ceramic	50V	10000pF	+80 -20%	R

Symbol	Part Code	Description	Q'ty
C 1450	CCC1011	C, Ceramic 50V 33 pF ±5%	1
C 1500	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 1502	CES0133	C, AL Elyc 16V 47 μF ±20%	1
C 1503	CCC1133	C, Ceramic 50V 1 pF ±0.25pF	1
C 1504	CES0133	C, AL Elyc 16V 47 μF ±20%	1
C 1505	CES0133	C, AL Elyc 16V 47 μF ±20%	1
C 1506	CCC1133	C, Ceramic 50V 1 pF ±0.25pF	1
C 1509	CES0133	C, AL Elyc 16V 47 μF ±20%	1
C 1700	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 1702	CES0133	C, AL Elyc 16V 47 μF ±20%	1
C 1704	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 2800	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 2803	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	R
CL 1383	AFD0010	Fil DST310-55D223S	1
CV 1314	CVE0046	C, Variable ECR-HA010A11	1
D 1254	HDS0437	Diode 1SS133	1
D 1255	HDS0437	Diode 1SS133	1
D 1261	HDS0437	Diode 1SS133	1
D 1262	HDS0437	Diode 1SS133	1
D 1263	HDS0437	Diode 1SS133	1
D 1311	HDM0051	Diode MA161	1
D 1312	HDM0051	Diode MA161	1
D 1313	HDS0437	Diode 1SS133	1
D 1330	HDS0477	Diode 1SS110	1
D 1353	HDS0437	Diode 1SS133	1
D 1354	HDS0437	Diode 1SS133	1
D 1356	HDS0437	Diode 1SS133	1
D 1357	HDS0437	Diode 1SS133	1
D 1360	HDS0437	Diode 1SS133	1
D 1380	HDL0048	Diode LN31GPH	1
D 1411	HDM0051	Diode MA161	1
D 1412	HDM0051	Diode MA161	1
D 1413	HDS0437	Diode 1SS133	1
D 1454	HDS0437	Diode 1SS133	1
F 1700	EFZ0013	IC Protect ICP-F10 (0.4A)	1
IC 1258	IDH0467	IC, Digital HD74LS00P	1
IC 1328	IDH0906	IC, Digital HD14529BP	1
IC 1331	8457940	IC, Hybrid UH-103	1
IC 1358	IDH0906	IC, Digital HD14529BP	1
IC 1428	IDH0906	IC, Digital HD14529BP	1
IC 2800	IDM0580	IC, Digital M57902L	1
IC 2801	ILU0010	IC, Analog UN4213	1
IC 2802	ILU0010	IC, Analog UN4213	1
IC 2803	ILU0010	IC, Analog UN4213	1
IC 2804	ILU0010	IC, Analog UN4213	1
IC 2805	ILU0010	IC, Analog UN4213	1
L 1301	TLE0086	Coil EL0606SKI 2R2K	1
L 1302	TLE0086	Coil EL0606SKI 2R2K	1
L 1401	TLE0086	Coil EL0606SKI 2R2K	1
L 1402	TLE0086	Coil EL0606SKI 2R2K	1
P 1380	JBB0026	Connector B10B-XH-A	1
P 1381	JBS0052	Connector SLEM19R-2	1
P 1382	JBS0061	Connector SLEM27R-2	1
P 1383	JBB0028	Connector B4B-XH-A	R
P 1384	JBS0056	Connector SLEM9R-2	1

Symbol	Part Code	Description	Q'ty
P 1509	JBB0022	Connector B6B-XH-A	1
P 1702	JBB0028	Connector B4B-XH-A	1
P 1705	JBB0027	Connector B2B-XH-A	1
R 1019	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1251	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1252	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1253	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1254	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1256	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1257	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 1259	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1261	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1262	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1263	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1264	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1265	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1300	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1301	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1302	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1306	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1307	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1310	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1311	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1312	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1315	RME1370	R, Metal 1/4W 3.01kΩ ±1%	1
R 1316	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 1317	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1318	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 1319	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 1320	RCE0715	R, Carbon 1/2W 6.8kΩ ±5%	1
R 1321	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 1322	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1323	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1324	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1325	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1327	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1328	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1329	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 1330	RCE0787	R, Carbon 1/4W 33kΩ ±5%	1
R 1331	RME1092	R, Metal 1/4W 47.5kΩ ±1%	1
R 1332	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1333	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1335	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1336	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1337	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 1338	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1339	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1340	RME1073	R, Metal 1/4W 1.21kΩ ±1%	R
R 1341	RME1071	R, Metal 1/4W 825Ω ±1%	R
R 1342	RCE0749	R, Carbon 1/4W 22Ω ±5%	R
R 1343	RCE0749	R, Carbon 1/4W 22Ω ±5%	R
R 1344	RCE0753	R, Carbon 1/4W 47Ω ±5%	R
R 1350	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 1351	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R 1352	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1353	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1354	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1355	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1356	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1357	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 1358	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1359	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1360	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R 1361	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1380	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1400	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1401	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1402	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1406	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1407	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1410	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1411	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1412	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1415	RME1370	R, Metal 1/4W 3.01kΩ ±1%	1
R 1416	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 1417	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1418	RME1060	R, Metal 1/4W 100Ω ±1%	1
R 1419	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 1420	RCE0715	R, Carbon 1/2W 6.8kΩ ±5%	1
R 1421	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 1423	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1424	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1425	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1427	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1428	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1429	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 1430	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1432	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1435	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1436	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1437	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 1438	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1439	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1440	RME1073	R, Metal 1/4W 1.21kΩ ±1%	R
R 1441	RME1071	R, Metal 1/4W 825Ω ±1%	R
R 1442	RCE0749	R, Carbon 1/4W 22Ω ±5%	R
R 1443	RCE0749	R, Carbon 1/4W 22Ω ±5%	R
R 1444	RCE0753	R, Carbon 1/4W 47Ω ±5%	R
R 1450	RCE0764	R, Carbon 1/4W 390Ω ±5%	1
R 1451	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R 1452	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1454	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1500	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 1501	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1502	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R 1503	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1504	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
R 1505	RME1071	R, Metal 1/4W 825Ω ±1%	1
R 1506	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1507	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1508	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1509	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1510	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1511	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1512	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1513	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1514	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1700	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1704	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1705	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1710	RCE0784	R, Carbon 1/4W 18kΩ ±5%	1
R 2801	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2802	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2803	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2804	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 2805	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
RV 1251	RNE0048	VR, Metal EVN 39C00YB22(200)	1
RV 1325	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1326	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1327	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1425	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1426	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1427	RNE0053	VR, Metal EVN 39C00YB24(20K)	1
RV 1700	8348450H	VR, Metal CR29R 22kΩ	1
RV 1703	8410400	RV, Carbon EVJ-KAAP20B14	1
RV 1704	8410400	RV, Carbon EVJ-KAAP20B14	1
RV 1705	8410400	RV, Carbon EVJ-KAAP20B14	1
S 1710	8402061C	SW, Push SUJ1-000 Nonlock (Gray Nob)	1
TR 1251	HTA0224	Transistor 2SA1029 D	1
TR 1254	HTA0224	Transistor 2SA1029 D	1
TR 1255	HTA0224	Transistor 2SA1029 D	1
TR 1261	HTC0192	Transistor 2SC641K-C	1
TR 1301	HTA0290	Transistor 2SA1206	1
TR 1302	HTA0290	Transistor 2SA1206	1
TR 1315	HTK0110	Transistor 2SK332E	1
TR 1319	HTC0192	Transistor 2SC641K-C	1
TR 1320	HTC0338	Transistor 2SC1906	1
TR 1330	HTC0813	Transistor 2SC2853E	1
TR 1337	HTA0290	Transistor 2SA1206	1
TR 1338	HTC0192	Transistor 2SC641K-C	1
TR 1352	HTC0148	Transistor 2SC458-C-	1
TR 1356	HTA0224	Transistor 2SA1029 D	1
TR 1360	HTA0224	Transistor 2SA1029 D	1
TR 1361	HTC0148	Transistor 2SC458-C-	1
TR 1401	HTA0290	Transistor 2SA1206	1
TR 1402	HTA0290	Transistor 2SA1206	1
TR 1415	HTK0110	Transistor 2SK332E	1
TR 1419	HTC0192	Transistor 2SC641K-C	1
TR 1420	HTC0338	Transistor 2SC1906	1
TR 1430	HTC0813	Transistor 2SC2853E	1
TR 1437	HTA0290	Transistor 2SA1206	1
TR 1438	HTC0192	Transistor 2SC641K-C	1
TR 1452	HTC0192	Transistor 2SC641K-C	1
TR 1502	HTC0338	Transistor 2SC1906	1
TR 1505	HTC0338	Transistor 2SC1906	1
TR 1509	HTA0224	Transistor 2SA1029 D	1
TR 1510	HTA0224	Transistor 2SA1029 D	1
TR 1700	HTC0148	Transistor 2SC458-C-	1
TR 1701	HTA0224	Transistor 2SA1029 D	1
TR 1705	HTC0148	Transistor 2SC458-C-	1
TR 1708	HTD0145	Transistor 2SD1267AP	1
R 1453	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1380	RCE0767	R, Carbon 1/4W 680Ω ±5%	1

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Symbol	Part Code	Description	Q'ty
C 1552	CCC1011	C, Ceramic 50V 33 pF ±5%	1
C 1569	CCC1014	C, Ceramic 50V 47 pF ±5%	1
C 1570	CCC1182	C, Ceramic 50V 1000 pF ±10%	1
C 1573	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 1577	CCC1014	C, Ceramic 50V 47 pF ±5%	1
C 1578	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 1600	CQA0122	C, Plastic 50V 47000pF ±10%	1
C 1624	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 1625	CCC0996	C, Ceramic 50V 2 pF ±0.25pF	1
C 1626	CCC0996	C, Ceramic 50V 2 pF ±0.25pF	1
C 1636	CCC1004	C, Ceramic 50V 15pF ±5%	1
C 1637	CCD0272	C, Ceramic 500V 1 pF ±0.25pF	1
C 1638	CCC1004	C, Ceramic 50V 15pF ±5%	1
C 1639	CCD0272	C, Ceramic 500V 1 pF ±0.25pF	1
C 1640	CCC1007	C, Ceramic 50V 22 pF ±5%	1
C 1642	CCC1007	C, Ceramic 50V 22 pF ±5%	1
C 1643	CCC1007	C, Ceramic 50V 22 pF ±5%	1
C 1648	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 1652	CCC1029	C, Ceramic 50V 1000 pF ±10%	1
C 1656	CCD0287	C, Ceramic 500V 4700 pF +100/-0%	1
C 1657	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 1658	CCD0287	C, Ceramic 500V 4700 pF +100/-0%	1
C 1659	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
C 1660	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C 1662	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C 1683	CCC1030	C, Ceramic 50V 10000 pF +80/-20%	1
CV 1640	CVE0055	C, Variable 250V 6 pF	1
D 1550	HDM0141	Diode MTZ 7.5JC	1
D 1642	HDM0140	Diode MTZ 4.7JB	1
D 1643	HDM0140	Diode MTZ 4.7JB	1
D 1660	HDS0437	Diode 1SS133	1
D 1662	HDS0437	Diode 1SS133	1
J 1500	8193940	Pin For Connector	1
J 1501	8193940	Pin For Connector	1
L 1550	TLE0063	Coil EL0606SK1 330K	1
L 1595	TLE0067	Coil EL0606SK1 680K	1
P 1500	JBX2096	Connector 2-164711-0	1
R 1560	RCE0762	R, Carbon 1/4W 270Ω ±5%	1
R 1562	RME1070	R, Metal 1/4W 681Ω ±1%	1
R 1563	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1564	RME1070	R, Metal 1/4W 681Ω ±1%	1
R 1565	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1566	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1567	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1568	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1569	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 1570	RME1068	R, Metal 1/4W 475Ω ±1%	1
R 1571	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 1572	RME1067	R, Metal 1/4W 392Ω ±1%	1
R 1573	RME1244	R, Metal 1/4W 3.65kΩ ±1%	1
R 1574	RME1069	R, Metal 1/4W 562Ω ±1%	1

Symbol	Part Code	Description	Q'ty
R 1575	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R 1577	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 1578	RME1066	R, Metal 1/4W 332Ω ±1%	1
R 1579	RME1066	R, Metal 1/4W 332Ω ±1%	1
R 1580	RME1121	R, Metal 1/4W 1.37kΩ ±1%	1
R 1585	RCE0760	R, Carbon 1/4W 180Ω ±5%	1
R 1588	RME1066	R, Metal 1/4W 332Ω ±5%	1
R 1589	RME1066	R, Metal 1/4W 332Ω ±1%	1
R 1595	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1596	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R 1597	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1598	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 1599	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1600	RCE0833	R, Carbon 1/4W 240kΩ ±5%	1
R 1601	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1602	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1603	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1606	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1608	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1610	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R 1611	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R 1615	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 1616	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R 1620	RME1066	R, Metal 1/4W 332Ω ±1%	1
R 1621	RME1066	R, Metal 1/4W 332Ω ±1%	1
R 1623	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1624	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1630	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1631	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1633	RME1063	R, Metal 1/4W 182Ω ±1%	1
R 1634	RME1063	R, Metal 1/4W 182Ω ±1%	1
R 1637	RME1368	R, Metal 2W 10kΩ ±5%	1
R 1638	RME1368	R, Metal 2W 10kΩ ±5%	1
R 1640	RCE0771	R, Carbon 1/4W 1.5kΩ ±5%	1
R 1642	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 1643	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 1646	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1647	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1648	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1649	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1650	RCE0795	R, Carbon 1/4W 150kΩ ±5%	1
R 1651	RCE0795	R, Carbon 1/4W 150kΩ ±5%	1
R 1652	RCE0796	R, Carbon 1/4W 180kΩ ±5%	1
R 1655	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1656	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R 1657	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1658	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1660	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1661	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 1662	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1663	RCE0759	R, Carbon 1/4W 150Ω ±5%	1
R 1665	RZZ0032	R, Fusing RF-25S 470ΩJ	1
R 1666	RCE0791	R, Carbon 1/4W 68kΩ ±5%	1
R 1668	RZZ0032	R, Fusing RF-25S 470ΩJ	1
R 1669	RCE0791	R, Carbon 1/4W 68kΩ ±5%	1
R 1671	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1672	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R 1680	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 1681	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1683	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R 1684	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1686	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R 1687	RME1088	R, Metal 1/4W 22.1kΩ ±1%	1

Symbol	Part Code	Description		Q'ty
RT 1605	HDE0058	Thermistor	ERT-D2ZHK332S	1
RV 1560	RNE0073	VR, Metal	EVN 49C00YB22 (200)	1
RV 1573	RNE0067	VR, Metal	EVN 49C00YB13 (1K)	1
RV 1585	RNE0073	VR, Metal	EVN 49C00YB22 (200)	1
RV 1601	RNE0077	VR, Metal	EVN 49C00YB23 (2kΩ)	1
RV 1602	RNE0071	VR, Metal	EVN 49C00YB52 (500)	1
RV 1608	RNE0076	VR, Metal	EVN 49C00YB12 (100Ω)	1
TR 1550	HTA0224	Transistor	2SA1029 D	1
TR 1560	HTA0224	Transistor	2SA1029 D	1
TR 1561	HTA0224	Transistor	2SA1029 D	1
TR 1570	HTC0148	Transistor	2SC458-C-	1
TR 1571	HTC0148	Transistor	2SC458-C-	1
TR 1585	HTC0338	Transistor	2SC1906	1
TR 1586	HTC0338	Transistor	2SC1906	1
TR 1595	HTC0148	Transistor	2SC458-C-	1
TR 1596	HTC0148	Transistor	2SC458-C-	1
TR 1600	HTA0290	Transistor	2SA1206	1
TR 1601	HTA0290	Transistor	2SA1206	1
TR 1602	HTA0290	Transistor	2SA1206	1
TR 1603	HTA0290	Transistor	2SA1206	1
TR 1620	HTC0192	Transistor	2SC641K-C	1
TR 1621	HTC0192	Transistor	2SC641K-C	1
TR 1630	HTC0338	Transistor	2SC1906	1
TR 1631	HTC0338	Transistor	2SC1906	1
TR 1642	HTC0768	Transistor	2SC2408	1
TR 1643	HTC0768	Transistor	2SC2408	1
TR 1660	HTA0258	Transistor	2SA1210S	1
TR 1661	HTC0669	Transistor	2SC2912S	1
TR 1662	HTA0258	Transistor	2SA1210S	1
TR 1663	HTC0669	Transistor	2SC2912S	1
TR 1683	HTA0224	Transistor	2SA1029 D	1
TR 1684	HTA0224	Transistor	2SA1029 D	1

EF-741 PS(INVERT-AC IN)

Symbol	Part Code	Description		Q'ty
	8457984	Sheet	30X55 94V-1	1
C 1800	CQE0118	C, Plastic	ECQ-E2A224MW	1
C 1801	CQE0118	C, Plastic	ECQ-E2A224MW	1
C 1802	CCD0337	C, Ceramic	DE7090B102K-VA1-KC	1
C 1803	CCD0337	C, Ceramic	DE7090B102K-VA1-KC	1
C 1804	CCD0338	C, Ceramic	DE7100F222M-VA1-KC	1
C 1805	CCD0337	C, Ceramic	DE7090B102K-VA1-KC	1
C 1806	CEK0144	C, AL Elyc	KME400VNSN220 30F	1
C 1814	CCC1030	C, Ceramic	50V 10000 pF +80/-20%	1
C 1820	CCD0338	C, Ceramic	DE7100F222M-VA1-KC	1
C 1822	CEK0076	C, AL Elyc	16V 10μF ±20%	1
C 1823	CES0215	C, AL Elyc	16V 220μF ±20%	1

Symbol	Part Code	Description		Q'ty
C 1824	CES0215	C, AL Elyc	16V 220μF ±20%	1
C 1830	CCD0231	C, Ceramic	2000V 4700 pF +80/-20%	1
C 1840	CCD0336	C, Ceramic	DE0707B221K2KV	1
C 1857	CCD0246	C, Ceramic	2kV 1000 pF ±10%	1
C 1880	CCC0590	C, Ceramic	500V 1000 pF	1
C 1891	CQE0062	C, Plastic	50V 1MF ±5%	1
D 1800	HDD0155	Diode	DBA40KG-15	1
D 1801	HDD0141	Diode	DTA10E	1
D 1812	HDS0437	Diode	1SS133	1
D 1830	HDU0016	Diode	V07L	1
D 1840	HDU0016	Diode	V07L	1
D 1850	HDV0044	Diode	V09E	1
D 1854	HDL0030	Diode	LN2G (Red-Led)	1
D 1860	HDS0553	Diode	SB50-18 (180V 5A)	1
D 1870	HDS0553	Diode	SB50-18 (180V 5A)	1
D 1880	HDS0553	Diode	SB50-18 (180V 5A)	1
IC 1811	HZP0013	Photocouple	PC714U	1
IC 1812	ILS0076	IC, Analog	S22MD1	1
IC 1820	ILS0077	IC, Analog	STK-7408	1
L 1800	TLS0096	Coil	SC-04-200JV	1
L 1827	TLX0175	Coil	BL02RN1-R62	1
L 1841	TLX0175	Coil	BL02RN1-R62	1
L 1851	TLX0175	Coil	BL02RN1-R62	1
P 1870	JBX1927	Connector	1-164713-5	1
R 1803	RCE0697	R, Carbon	1/2W 220Ω ±5%	1
R 1818	RCE0705	R, Carbon	1/2W 1.0kΩ ±5%	1
R 1819	RCE0703	R, Carbon	1/2W 680Ω ±5%	1
R 1820	RCE0718	R, Carbon	1/2W 12kΩ ±5%	1
R 1821	RCR3516	R, Carbon	1/2W 820kΩ ±5%	1
R 1822	RCE0734	R, Carbon	1/2W 680kΩ ±5%	1
R 1823	RME1494	R, Metal	2W 100kΩ ±5%	1
R 1824	RZZ0053	R, Fusing	ERQ-3Cj3.3kΩ	1
R 1826	RME1492	R, Metal	1W 15Ω ±5%	1
R 1827	RME1497	R, Metal	3W 0.68Ω ±5%	1
R 1828	RCE0710	R, Carbon	1/2W 2.7kΩ ±5%	1
R 1829	RCE0719	R, Carbon	1/2W 15kΩ ±5%	1
R 1830	RME1540	R, Metal	3W 68Ω ±5%	1
R 1831	RME1541	R, Metal	2W 6.8kΩ ±5%	1
R 1857	RME1534	R, Metal	3W 100Ω ±5%	1
R 1880	RME1542	R, Metal	1W 680Ω ±5%	1
R 1890	RCE0705	R, Carbon	1/2W 1.0kΩ ±5%	1
S 1800	8456530	SW, Push	SDS 3P (Flex Type)	1
T 1810	8455056	XFMR	8455056 (V-1150)	1
R 1850	RZZ0052	R, Fusing	RF50S 1Ω	1

PEF-742 PS(REGULATER)

Symbol	Part Code	Description	Q'ty
C 1842	CEK0166	C, AL Elyc 160V 22μF ±20%	1
C 1851	CES0356	C, AL Elyc 63V 220μF ±20%	1
C 1862	CEK0078	C, AL Elyc 16V 47μF ±20%	1
C 1863	CEK0078	C, AL Elyc 16V 47μF ±20%	1
C 1864	CEK0078	C, AL Elyc 16V 47μF ±20%	1
C 1872	CEK0088	C, AL Elyc 50V 10μF ±20%	1
C 1873	CCC1190	C, Ceramic 50V 4700pF ±10%	1
C 1874	CES0215	C, AL Elyc 16V 220μF ±20%	1
C 1875	CES0215	C, AL Elyc 16V 220μF ±20%	1
C 1882	CEK0088	C, AL Elyc 50V 10μF ±20%	1
C 1883	CEK0085	C, AL Elyc 50V 1.0μF ±20%	1
C 1884	CES0215	C, AL Elyc 16V 220μF ±20%	1
D 1861	HDS0546	Diode SB10-05H	1
IC 1860	ILS0074	IC, Analog SI-3052V	1
IC 1875	ILM0408	IC, Analog M5230L	1
P 1840	JBB0058	Connector B12B-XH-A	1
P 1850	JBB0023	Connector B8B-XH-A	1
P 1860	JBB0022	Connector B6B-XH-A	1
P 1872	JBB0021	Connector B3B-XH-A	1
P 1873	JBB0023	Connector B8B-XH-A	1
R 1871	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1872	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1873	RME1086	R, Metal 1/4W 15.0kΩ ±1%	1
R 1874	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 1881	RCE0761	R, Carbon 1/4W 220Ω ±5%	1
R 1882	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 1883	RME1086	R, Metal 1/4W 15.0kΩ ±1%	1
R 1884	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 1885	RME1086	R, Metal 1/4W 15.0kΩ ±1%	1
RV 1885	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
TR 1870	HTD0180	Transistor 2SD1668R	1
TR 1880	HTB0162	Transistor 2SB1135R	1

PEF-743 ILLUMI

Symbol	Part Code	Description	Q'ty
PL 1705	ELL0081	Lamp 12V 0.11A	1
PL 1706	ELL0081	Lamp 12V 0.11A	1
PL 1707	ELL0081	Lamp 12V 0.11A	1

PEF-744 CRT

Symbol	Part Code	Description	Q'ty
C 1751	CCD0231	C, Ceramic 2000V 4700pF +80 -20%	1
C 1752	CCD0231	C, Ceramic 2000V 4700pF +80 -20%	1
C 1753	CCC1025	C, Ceramic 50V 100pF ±10%	1
C 1755	CCC1030	C, Ceramic 50V 10000pF +80 -20%	1
C 1756	CCC1030	C, Ceramic 50V 10000pF +80 -20%	1
J 1790	JSP0001	Socket PS-085	1
P 1704	JBB0021	Connector B3B-XH-A	1
P 1705	JBB0022	Connector B6B-XH-A	1
P 1708	JBB0021	Connector B3B-XH-A	1
P 1709	JBB0021	Connector B3B-XH-A	1
R 1751	RMV0009	R, Metal 1/2W 6.8MΩ ±5%	1
R 1752	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1753	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1754	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 1755	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 1756	RCE0745	R, Carbon 1/4W 10Ω ±5%	1

PEF-745 M.COM

Symbol	Part Code	Description	Q'ty
	IYX0041	IC, Socket 10628-01-445	1
	IYT0003	Seal (Rom) 11X11mm T-Type Mat Silver	1
BB 1	ETZ0117	Minibus NC3523-08	1
BB 2	ETZ0118	Minibus NC3527-07	1
BB 3	ETZ0119	Minibus NC3526-00	1
BB 4	ETZ0117	Minibus NC3523-08	1
C 2001	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2002	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2004	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2005	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2006	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2007	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2008	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2009	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2010	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2011	CCG0217	C, Ceramic Chip 50V 0.047μF ±10%	1
C 2012	CES0267	C, AL Elyc 10V 390μF ±20%	1
C 2013	CCG0217	C, Ceramic Chip 50V 0.047μF ±10%	1
C 2014	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2015	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2016	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2017	CCG0144	C, Ceramic Chip 50V 220pF ±5%	1
C 2018	CES0133	C, AL Elyc 16V 47μF ±20%	1

Symbol	Part Code	Description	Q'ty
C 2019	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2020	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2022	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2023	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2024	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2025	CDE0001	C, 2-Layer EECN5R5F473 (0.047F)	1
C 2026	CCG0207	C, Ceramic Chip 50V 2200pF ±10%	1
C 2027	CQA0122	C, Plastic 50V 47000pF ±10%	1
C 2028	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2029	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2030	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2031	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2036	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2037	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2038	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2039	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2040	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2041	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2042	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2043	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2044	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2045	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2046	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2047	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2048	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2050	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2051	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2052	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2053	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2055	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2056	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2057	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2058	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2059	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2060	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2061	CES0267	C, AL Elyc 10V 390μF ±20%	1
C 2091	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2097	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 2102	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2104	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2105	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2106	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2113	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2114	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2115	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2120	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2122	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2123	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2127	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2130A	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2131	CCG0136	C, Ceramic Chip 50V 33pF ±5%	1
C 2136	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2137	CCG0201	C, Ceramic Chip 50V 470pF ±5%	1
C 2138	CCG0201	C, Ceramic Chip 50V 470pF ±5%	1
C 2142	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2143	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1

Symbol	Part Code	Description	Q'ty
C 2144	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2145	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2146	CCG0143	C, Ceramic Chip 50V 100pF ±5%	1
C 2147	CCG0143	C, Ceramic Chip 50V 100pF ±5%	1
C 2148	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2150	CCG0208	C, Ceramic Chip 50V 3300pF ±10%	1
C 2151	CCG0209	C, Ceramic Chip 50V 4700pF ±10%	1
C 2154	CQA0125	C, Plastic 50V 4700pF ±10%	1
C 2159	CCG0207	C, Ceramic Chip 50V 2200pF ±10%	1
C 2160	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
C 2161	CCG0211	C, Ceramic Chip 50V 10000pF ±10%	1
CL 2001	AFD0010	Fil DST310-55D223S	1
CL 2002	AFD0010	Fil DST310-55D223S	1
CL 2003	AFD0010	Fil DST310-55D223S	1
CL 2006	AFD0010	Fil DST310-55D223S	1
CL 2010	AFD0010	Fil DST310-55D223S	1
D 2001	HDS0437	Diode 1SS133	1
D 2002	HDM0139	Diode MTZ 3.3JA	1
D 2003	HDS0437	Diode 1SS133	1
D 2005	HDS0437	Diode 1SS133	1
IC 2001	IDH0896	IC, Digital HD14051BFP	1
IC 2002	IDM0570	IC, Digital UPD70008AG-4	1
IC 2003	8456529	IC, Digital LQV-4M00-012	1
IC 2004	IDT0144	IC, Digital TC40H374F	1
IC 2005	IDT0091	IC, Digital TC40H373F	1
IC 2006	IDT0091	IC, Digital TC40H373F	1
IC 2007	IDT0091	IC, Digital TC40H373F	1
IC 2008	ILN0048	IC, Analog NJM311M	1
IC 2009	IDT0078	IC, Digital TC40H000F	1
IC 2010	IDT0078	IC, Digital TC40H000F	1
IC 2012	IDT0080	IC, Digital TC40H004F	1
IC 2013	IDH1049	IC, Digital HN27256G-30 (MBM27256-30)	1
IC 2014	IDT0085	IC, Digital TC40H138F	1
IC 2015	IDT0085	IC, Digital TC40H138F	1
IC 2016	IDT0085	IC, Digital TC40H138F	1
IC 2017	IDT0083	IC, Digital TC40H074F	1
IC 2018	IDM0571	IC, Digital UPD446G-20	1
IC 2019	IDT0127	IC, Digital TC40H259F	1
IC 2020	IDT0127	IC, Digital TC40H259F	1
IC 2022	ILN0058	IC, Analog NJM072M	1
IC 2023	IDM0483	IC, Digital MB88301A	1
IC 2024	IDT0144	IC, Digital TC40H374F	1
IC 2025	IDT0144	IC, Digital TC40H374F	1
IC 2026	IZH0018	IC, Hybrid HA17012PB	1
IC 2027	IDH0896	IC, Digital HD14051BFP	1
IC 2028	ILT0066	IC, Analog TL064CNS	1
IC 2029	ILT0066	IC, Analog TL064CNS	1
IC 2102	IDT0147	IC, Digital TC74HC86F	1
IC 2104	IDT0079	IC, Digital TC40H002F	1
IC 2105	IDT0080	IC, Digital TC40H004F	1
IC 2106	ILN0059	IC, Analog NJM4558M	1
IC 2107	IDH0897	IC, Digital HD14052BFP	1
IC 2108	ILN0059	IC, Analog NJM4558M	1
IC 2109	IDT0148	IC, Digital TC74HC123F	1
IC 2113	IDM0571	IC, Digital UPD446G-20	1
IC 2114	IDT0089	IC, Digital TC40H245F	1
IC 2115	IDT0146	IC, Digital TC40H151F	1
IC 2120	IDT0161	IC, Digital TC40H051F	1
IC 2121	IDM0579	IC, Digital MN74HC393S	1

Symbol	Part Code	Description	Q'ty
IC 2122	IDM0579	IC, Digital MN74HC393S	1
IC 2123	IDT0152	IC, Digital TC40H164F	1
IC 2126	IDH0897	IC, Digital HD14052BFP	1
IC 2127	IDT0143	IC, Digital TC40H020F	1
L 2011	TLE0086	Coil EL0606SK1 2R2K	1
L 2012	TLE0058	Coil EL0606SK1 100K	1
L 2048	TLE0058	Coil EL0606SK1 100K	1
L 2131	TLE0067	Coil EL0606SK1 680K	1
L 2142	TLE0058	Coil EL0606SK1 100K	1
P 1607	JBB0027	Connector B2B-XH-A	1
P 1815	JBB0022	Connector B6B-XH-A	1
P 2000	JBB0027	Connector B2B-XH-A	1
P 2001	JBS0050	Connector SLEM15R-2	1
P 2002	JBS0050	Connector SLEM15R-2	1
P 2003	JBS0033	Connector SLEM21R-2	1
P 2004	JBS0033	Connector SLEM21R-2	1
P 2006	JBS0055	Connector SLEM30R-2	1
P 2008	JBS0061	Connector SLEM27R-2	1
R 2001	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2002	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2003	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2004	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2005	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2006	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2007	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2008	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2009	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2010	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2011	RME0900	R, Metal Chip 1/8W 100kΩ ±5%	1
R 2012	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2013	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2014	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 2015	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2016	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2017	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2018	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2019	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2020	RME1084	R, Metal 1/4W 10kΩ ±1%	1
R 2021	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2022	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2023	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2024	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2025	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 2026	RME0902	R, Metal Chip 1/8W 220kΩ ±5%	1
R 2027	RMS0050	R, Metal 1/4W 800kΩ ±0.5%	1
R 2028	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2029	RME0906	R, Metal Chip 1/8W 1.0MΩ ±5%	1
R 2030	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 2036	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2037	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2038	RME0862	R, Metal Chip 1/8W 68Ω ±5%	1
R 2039	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2040	RME0883	R, Metal Chip 1/8W 3.9kΩ ±5%	1
R 2041	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2042	RME0880	R, Metal Chip 1/8W 2.2kΩ ±5%	1
R 2043	RME0870	R, Metal Chip 1/8W 330Ω ±5%	1
R 2044	RME0870	R, Metal Chip 1/8W 330Ω ±5%	1
R 2045	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2046	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R 2047	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2048	RME1159	R, Metal 1/4W 28.7kΩ ±0.5%	1
R 2049	RME1373	R, Metal 1/4W 400kΩ ±0.5%	1
R 2050	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2051	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2052	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2053	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2054	RME0856	R, Metal Chip 1/8W 22Ω ±5%	1
R 2055	RME1127	R, Metal 1/4W 6.19kΩ ±1%	1
R 2056	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 2057	RME1145	R, Metal 1/4W 60.0Ω ±0.5%	1
R 2058	RME1127	R, Metal 1/4W 6.19kΩ ±1%	1
R 2059	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R 2060	RME1145	R, Metal 1/4W 60.0Ω ±0.5%	1
R 2061	RME0888	R, Metal Chip 1/8W 10kΩ ±5%	1
R 2062	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 2063	RME0869	R, Metal Chip 1/8W 270Ω ±5%	1
R 2071	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 2072	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 2073	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 2074	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 2075	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 2076	RME1193	R, Metal 1/4W 11.0kΩ ±1%	1
R 2077	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 2078	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R 2079	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2080	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2082	RME0900	R, Metal Chip 1/8W 100kΩ ±5%	1
R 2083	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2084	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2085	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	R
R 2086	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2087	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2088	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 2089	RME0860	R, Metal Chip 1/8W 47Ω ±5%	1
R 2090	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2091	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2092	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 2093	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2094	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R 2095	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2096	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2097	RME0892	R, Metal Chip 1/8W 22kΩ ±5%	1
R 2098	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2099	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R 2102	RME0912	R, Metal Chip Zero ohm Resistor	1
R 2103	RME0912	R, Metal Chip Zero ohm Resistor	1
R 2106	RME0912	R, Metal Chip ERJ-8GC Zero ohm Resistor	1
R 2110	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2111	RME1086	R, Metal 1/4W 15.0kΩ ±1%	1
R 2112	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R 2113	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R 2114	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2115	RME1079	R, Metal 1/4W 3.92kΩ ±1%	1
R 2116	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 2117	RCE0778	R, Carbon 1/4W 5.6kΩ ±5%	1
R 2118	RME1100	R, Metal 1/4W 221kΩ ±1%	1
R 2119	RME1092	R, Metal 1/4W 47.5kΩ ±1%	1
R 2120	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2121	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R 2123	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2124	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2125	RME0868	R, Metal Chip 1/8W 220Ω ±5%	1
R 2126	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2127	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2128	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2129	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2130	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 2131	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 2136	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2137	RME0852	R, Metal Chip 1/8W 10Ω ±5%	1
R 2138	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2139	RME0872	R, Metal Chip 1/8W 470Ω ±5%	1
R 2140	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2143	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2148	RME0887	R, Metal Chip 1/8W 8.2kΩ ±5%	1
R 2151	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2152	RME0906	R, Metal Chip 1/8W 1.0MΩ ±5%	1
R 2153	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2154	RME0894	R, Metal Chip 1/8W 33kΩ ±5%	1
R 2155	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 2156	RME0900	R, Metal Chip 1/8W 100kΩ ±5%	1
R 2157	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2158	RME0889	R, Metal Chip 1/8W 12kΩ ±5%	1
R 2160	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2161	RME0904	R, Metal Chip 1/8W 470kΩ ±5%	1
R 2176	RME1412	R, Metal 1/4W 4.32kΩ ±1%	1
R 2177	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 2178	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2180	RME1096	R, Metal 1/4W 100kΩ ±1%	1
R 2181	RCE0815	R, Carbon 1/4W 200kΩ ±5%	1
R 2182	RCE0815	R, Carbon 1/4W 200kΩ ±5%	1
R 2183	RCE0815	R, Carbon 1/4W 200kΩ ±5%	1
R 2186	RME1193	R, Metal 1/4W 11.0kΩ ±1%	1
R 2187	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
RM 2005	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2006	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2007	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2010	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2011	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2012	RZA0115	R, Bloc EXB-P8-8-473-J	1
RM 2101	RCE0852	R, Carbon EXB-LD8-503G	1
RV 2001	RNE0077	VR, Metal EVN 49C00YB23 (2K)	1
TR 2001	HTA0263	Transistor 2SA1052D	1
TR 2002	HTC0691	Transistor 2SC2735	1
TR 2003	HTA0263	Transistor 2SA1052D	1
TR 2004	HTC0691	Transistor 2SC2735	1
TR 2005	HTD0161	Transistor DTC124K	1
TR 2091	HTA0263	Transistor 2SA1052D	1
TR 2092	HTA0263	Transistor 2SA1052D	1
TR 2093	HTA0263	Transistor 2SA1052D	1
TR 2094	HTA0263	Transistor 2SA1052D	1
TR 2158	HTA0263	Transistor 2SA1052D	1
TR 2181	HTD0161	Transistor DTC124K	1
TR 2182	HTD0161	Transistor DTC124K	1

PEF-746 SW PANEL

Symbol	Part Code	Description	Q'ty
C 2900	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2901	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2902	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2903	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2904	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2905	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
C 2906	CCG0213	C, Ceramic Chip 50V 0.1μF +80/-20%	1
D 2901	HDS0532	Diode SLP-174B	1
D 2902	HDS0532	Diode SLP-174B	1
D 2937	HDS0532	Diode SLP-174B	1
IC 2900	IDD0047	IC, Digital DN74LS164S	1
IC 2901	IDD0047	IC, Digital DN74LS164S	1
IC 2902	IDD0047	IC, Digital DN74LS164S	1
IC 2903	IDD0047	IC, Digital DN74LS164S	1
IC 2904	IDD0047	IC, Digital DN74LS164S	1
IC 2905	IDT0145	IC, Digital TC40H148F	1
P 2960	JBP0159	Connector PS10PA-S4T1-A1	1
P 2961	JBP0159	Connector PS10PA-S4T1-A1	1
R 2900	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 2905	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2906	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2907	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2908	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2909	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2910	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2911	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2912	RME0884	R, Metal Chip 1/8W 4.7kΩ ±5%	1
R 2913	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2914	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2915	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2917	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2918	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2919	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2920	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2921	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2922	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2923	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2924	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2925	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2926	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2927	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2928	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2929	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2930	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2931	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2932	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2933	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2934	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1

PEF-747 VR PANEL

Symbol	Part Code	Description	Q'ty
R 2935	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2936	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2937	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2938	RME0869	R, Metal Chip 1/8W 270Ω ±5%	1
R 2939	RME0869	R, Metal Chip 1/8W 270Ω ±5%	1
R 2940	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2941	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2942	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2943	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2944	RME0896	R, Metal Chip 1/8W 47kΩ ±5%	1
R 2945	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
R 2946	RME0873	R, Metal Chip 1/8W 560Ω ±5%	1
S 2900	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2901	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2902	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2903	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2904	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2905	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2906	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2908	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2910	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2911	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2912	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2913	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2914	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2915	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2916	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2917	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2918	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2919	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2920	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2921	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2922	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2923	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2924	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2925	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2926	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2927	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2928	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2929	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2930	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2931	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2932	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2933	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2934	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2935	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2936	SSB0006	SW KHJ11901 (With 86H3P)	1
S 2938	SSB0006	SW KHJ11901 (With 86H3P)	1
TR 2901	HTC0808	Transistor 2SC2618C/2SC2411KQ	1
TR 2902	HTC0808	Transistor 2SC2618C/2SC2411KQ	1
TR 2903	HTC0808	Transistor 2SC2618C/2SC2411KQ	1
TR 2904	HTC0808	Transistor 2SC2618C/2SC2411KQ	1
TR 2905	HTC0808	Transistor 2SC2618C/2SC2411KQ	1

Symbol	Part Code	Description	Q'ty
C 2950	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2951	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 2952	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2953	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2955	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2957	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2971	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2974	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
C 2975	CCC1030	C, Ceramic 50V 10000pF $^{+80}_{-20}$%	1
IC 2950	ILB0010	IC, Analog BA715	1
IC 2952	IDH0800	IC, Digital HD14051BP	1
IC 2953	IDH0802	IC, Digital HD14053BP	1
IC 2954	ILN0042	IC, Analog NJM 072S	1
P 2600	JBS0055	Connector SLEM30R-2	1
P 2610	JBP0152	Connector FS-10SD-S4TS1-1	1
P 2611	JBP0152	Connector PS-10SD-S4TS1-1	1
R 2950	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2951	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2952	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2953	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2954	RME1207	R, Metal 1/4W 75.0kΩ ±1%	1
R 2955	RME1207	R, Metal 1/4W 75.0kΩ ±1%	1
R 2962	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 2963	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 2964	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 2965	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R 2966	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2967	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 2968	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 2969	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R 2970	RME1123	R, Metal 1/4W 2.43kΩ ±1%	1
R 2971	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 2972	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 2973	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
RV 2950	8457969	VR, Carbon V12 L5(PVB)N	1
RV 2951	8457969	VR, Carbon V12 L5(PVB)N	1
RV 2952	8457969	VR, Carbon V12 L5(PVB)N	1
RV 2953	8457969	VR, Carbon V12 L5(PVB)N	1
RV 2954	8457967	VR, Carbon V12 L5(PVB)N(3T.C)	1
RV 2955	8457969	VR, Carbon V12 L5(PVB)N	1
RV 2956	8457968	VR, Carbon V12 L5(360)(PVB)N	1
RV 2957	8457969	VR, Carbon V12 L5(PBV)N	1

EF-748 DVM

Symbol	Part Code	Description				Q'ty
C 2503	CCC1032	C, Ceramic	50V	82 pF	±5%	1
C 2505	CCC0996	C, Ceramic	50V	2 pF	±0.25pF	1
C 2506	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2512	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2513	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2515	CEX0189	C, AL Elyc	16V	10μF	±20%BP	1
C 2516	CCC1034	C, Ceramic	50V	68 pF	±5%	1
C 2517	CCC1002	C, Ceramic	50V	10 pF	±0.5pF	1
C 2518	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2519	CEX0189	C, AL Elyc	16V	10μF	±20%BP	1
C 2520	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2521	CCC0999	C, Ceramic	50V	5 pF	±0.25pF	1
C 2524	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2525	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2526	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2527	CCC1356	C, Ceramic	50V	470 pF	±10%	1
C 2528	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2529	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2536	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2540	CCC1007	C, Ceramic	50V	22 pF	±5%	1
C 2541	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2542	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2570	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2571	CQA0124	C, Plastic	50V	0.1μF	±10%	1
C 2572	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2573	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
C 2574	CQA0124	C, Plastic	50V	0.1μF	±10%	1
C 2575	CQA0124	C, Plastic	50V	0.1μF	±10%	1
C 2576	CES0133	C, AL Elyc	16V	47μF	±20%	1
C 2577	CCC1030	C, Ceramic	50V	10000 pF	+80 -20%	1
D 2502	HDM0139	Diode	MTZ 3.3JA			1
D 2503	HDX0055	Diode	1SS165			1
D 2504	HDX0055	Diode	1SS165			1
D 2506	HDS0477	Diode	1SS110			1
D 2512	HDH0040	Diode	Zenner HZ7(B)			1
D 2571	HDM0140	Diode	MTZ 4.7JB			1
IC 2501	ILN0046	IC, Analog	NJM2904S			1
IC 2571	IDH0800	IC, Digital	HD14051BP			1
IC 2572	IDM0479	IC, Digital	MC14433P			1
IC 2573	ILL0067	IC, Analog	LM336Z			1
IC 2574	IDH0786	IC, Digital	HD14014BP			1
IC 2575	ILU0010	IC, Analog	UN4213			1
P 601	JBB0023	Connector	B8B-XH-A			1
P 1394	JBS0057	Connector	SLEM9S-2			1
R 2501	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 2502	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 2503	RCE0760	R, Carbon	1/4W	180Ω	±5%	1
R 2505	RME1071	R, Metal	1/4W	825Ω	±1%	1
R 2506	RME1060	R, Metal	1/4W	100Ω	±1%	1
R 2507	RCE0753	R, Carbon	1/4W	47Ω	±5%	1

Symbol	Part Code	Description				Q'ty
R 2508	RCE0745	R, Carbon	1/4W	10Ω	±5%	1
R 2509	RCE0771	R, Carbon	1/4W	1.5kΩ	±5%	1
R 2510	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 2511	RCE0776	R, Carbon	1/4W	3.9kΩ	±5%	1
R 2512	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 2516	RCE0759	R, Carbon	1/4W	150Ω	±5%	1
R 2517	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R 2518	RCE0771	R, Carbon	1/4W	1.5kΩ	±5%	1
R 2519	RCE0788	R, Carbon	1/4W	39kΩ	±5%	1
R 2520	RCE0782	R, Carbon	1/4W	12kΩ	±5%	1
R 2521	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 2522	RCE0797	R, Carbon	1/4W	220kΩ	±5%	1
R 2523	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 2524	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 2525	RCE0749	R, Carbon	1/4W	22Ω	±5%	1
R 2526	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 2527	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R 2528	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 2529	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 2530	RCE0758	R, Carbon	1/4W	120Ω	±5%	1
R 2536	RME1064	R, Metal	1/4W	221Ω	±1%	1
R 2537	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 2538	RCE0765	R, Carbon	1/4W	470Ω	±5%	1
R 2539	RME1072	R, Metal	1/4W	1.00kΩ	±1%	1
R 2540	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R 2541	RME1084	R, Metal	1/4W	10.0kΩ	±1%	1
R 2542	RME1084	R, Metal	1/4W	10.0kΩ	±1%	1
R 2543	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R 2544	RME1193	R, Metal	1/4W	11.0kΩ	±1%	1
R 2545	RME1193	R, Metal	1/4W	11.0kΩ	±1%	1
R 2548	RCE0798	R, Carbon	1/4W	330kΩ	±5%	1
R 2549	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R 2554	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 2555	RME1148	R, Metal	1/4W	90.0Ω	±0.5%	1
R 2570	RCE0765	R, Carbon	1/4W	470Ω	±5%	1
R 2571	RCE0798	R, Carbon	1/4W	330kΩ	±5%	1
R 2572	RCE0786	R, Carbon	1/4W	27kΩ	±5%	1
R 2573	RME1085	R, Metal	1/4W	12.1kΩ	±1%	1
R 2574	RCE0773	R, Carbon	1/4W	2.2kΩ	±5%	1
R 2575	RME1118	R, Metal	1/4W	909Ω	±1%	1
R 2576	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R 2577	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R 2578	RME1076	R, Metal	1/4W	2.21kΩ	±1%	1
R 2579	RME1221	R, Metal	1/4W	1.37kΩ	±1%	1
R 2580	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
RV 2571	RNE0073	VR, Metal	EVN 49C00YB22 (200)			1
RV 2572	RNE0071	VR, Metal	EVN 49C00YB52 (500)			1
TR 2501	HTA0290	Transistor	2SA1206			1
TR 2502	HTC0338	Transistor	2SC1906			1
TR 2503	HTA0224	Transistor	2SA1029 D			1
TR 2505	HTC0168	Transistor	2SC535-C-			1
TR 2506	HTC0338	Transistor	2SC1906			1
TR 2507	HTC0338	Transistor	2SC1906			1

PEF-749 PS(UNREG)

Symbol	Part Code	Description	Q'ty
C 1841	CEK0113	C, AL Elyc 160V 33μF ±20%	1
C 1850	CES0327	C, AL Elyc 100V 220μF ±20%	1
C 1852	CCC1030	C, Ceramic 50V 10000pF +80/-20%	1
C 1853	CCS0017	C, Ceramic 50V 0.1μF +80/-20%	1
C 1861	CES0309	C, AL Elyc 25V 470μF ±20%	1
C 1871	CES0309	C, AL Elyc 25V 470μF ±20%	1
C 1881	CES0309	C, AL Elyc 25V 470μF ±20%	1
D 1851	HDM0144	Diode MTZ 22JD	1
D 1853	HDM0144	Diode MTZ22JD	1
F 1860	EFZ0012	IC Protect ICP-F75 (2.7A)	1
F 1870	EFZ0012	IC Protect ICP-F75 (2.7A)	1
F 1880	EFZ0012	IC Protect ICP-F75 (2.7A)	1
IC 1850	ILT0091	IC, Analog TL431CLP-B	1
J 1875	JBX1926	Connector 1-164711-5	1
L 1840	TLF0148	Coil FL-7H 6.8mH ±5%	1
L 1850	TLF0025	Coil FL9H 1mH ±5%	1
L 1860	TLS0097	Coil SN-5-300 25mH	1
L 1870	TLS0097	Coil SN-5-300 25mH	1
L 1880	TLS0097	Coil SN-5-300 25mH	1
P 1874	JBB0023	Connector B8B-XH-A	1
R 1840	RZZ0029	R, Fuse 1/2W 10Ω ±0.5%	1
R 1841	RCE0729	R, Carbon 1/2W 100kΩ ±5%	1
R 1843	RCE0790	R, Carbon 1/4W 56kΩ ±5%	1
R 1851	RCE0784	R, Carbon 1/4W 18kΩ ±5%	1
R 1852	RZZ0048	R, Fusing 1/2W 180Ω ±5%	1
R 1853	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1854	RME1095	R, Metal 1/4W 82.5kΩ ±1%	1
R 1855	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R 1856	RCE0705	R, Carbon 1/2W 1kΩ ±5%	1
RV 1853	RNE0068	VR, Metal EVN 49C00YB14 (10K)	1

PEF-750 PS(HEATER)

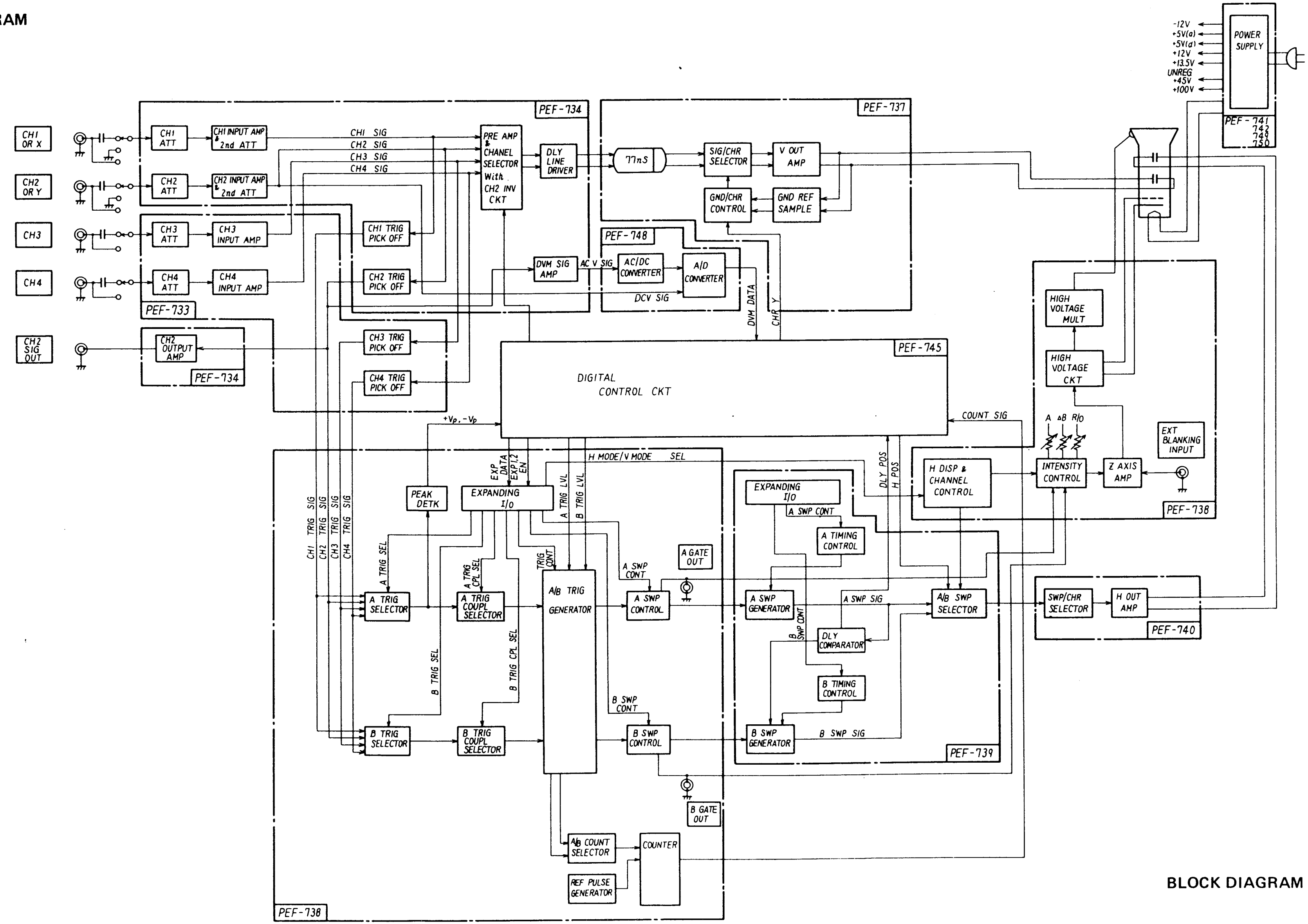
Symbol	Part Code	Description	Q'ty
C 1835	CQA0124	C, Plastic 50V 0.1μF ±5%	1
C 1836	CCC0590	C, Ceramic 500V 1000pF	1
D 1835	HDV0044	Diode V09E	1
D 1836	HDS0546	Diode SB10-05H	1

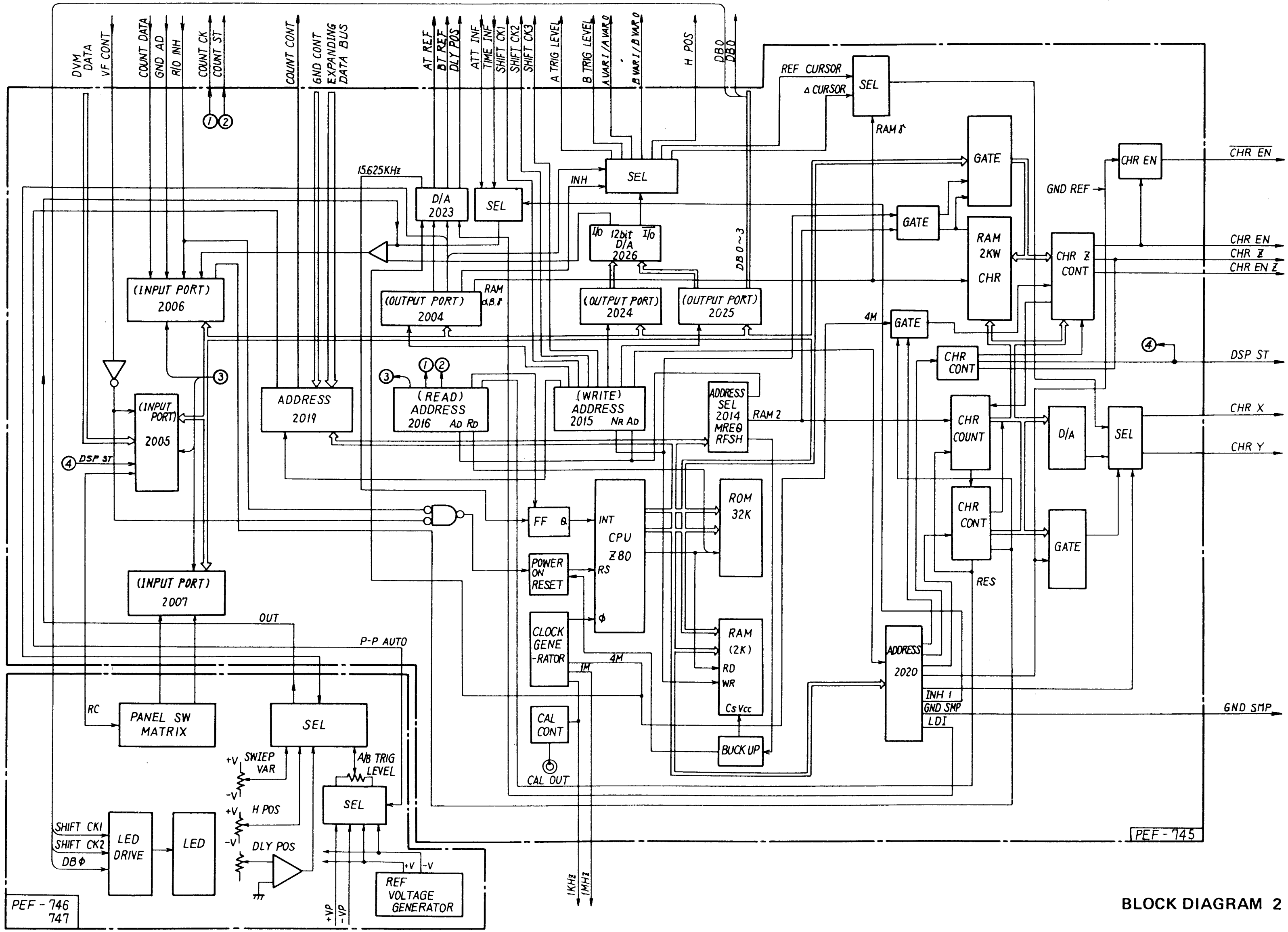
Symbol	Part Code	Description	Q'ty
F 1830	EFZ0013	IC Protect ICP-FIO (0.4A)	1
P 1836	JBB0021	Connector B3B-XH-A	1
R 1835	RME1543	R, Metal 1W 100Ω ±5%	1

CHASSIS

Symbol	Part Code	Description	Q'ty
	8455078C	Card, Fitt SMCD15X120BDX10	2
	8455078D	Card, Fitt SMCD19X25BDX10	1
	BBZ0285	Card, Fitt	1
	8455078K	Card, Fitt SMCD9X470BDX10	1
	8455078J	Card, Fitt SMCD27X240BDX10	1
	8455078E	Card, Fitt SMCD21X80BDX10	2
	3203301A	Cable Assy	1
	3203329	Cable Assy	1
	8457966A	Cable Assy	1
	8457972	Cable Assy	1
	8460790	Cable Assy	1
	8338351	Terminal Z-048 (Earth)	1
	8456532	Knob For SRAJ Switch	2
B1	EDF0118	Fan DF36A12-101B	1
C1	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
C201	CCC0999	C, Ceramic 50V 5pF ±0.25pF	1
DL600	8457959	Delay Line 77ns 140Ω 15m	1
F1800	FFG0688	Fuse MQ4-2A (250V,2A,UL)	1
J1	JHB0088	Coax. Con BNC071	1
J200	JHB0088	Coax. Con BNC071	1
J201	JHB0088	Coax. Con BNC071	1
J400	JHB0088	Coax. Con BNC071	1
J500	JHB0088	Coax. Con BNC071	1
J1502	JHB0088	Coax. Con BNC071	1
J1503	JHB0088	Coax. Con BNC071	1
J1606	8397022	Test Point Z069	1
J1721	JHB0088	Coax. Con BNC071	1
L1451	3189657	Coil Trace Rotation	1
P1800	JSG0002	Connector GS142R32-3131-150	1
R1	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R201	RCE0756	R, Carbon 1/4W 82Ω ±5%	1
RV1702	8446931	VR, Carbon EWH-YDRK20B14	1
	ERE0094		1
RV1787	RNE0069	VR, Metal EVM-MFGK20B26	1
C 405	CCC1004	C, Ceramic 50V 15pF ±5%	1
SG1	EZH0084	Spark Gap AG20 2.5kV	1
C 505	CCC1005	C, Ceramic 50V 18pF ±5%	1
V1490	8410384	CRT H6111-P31	1
R 405	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R 505	RCE0753	R, Carbon 1/4W 47Ω ±5%	1

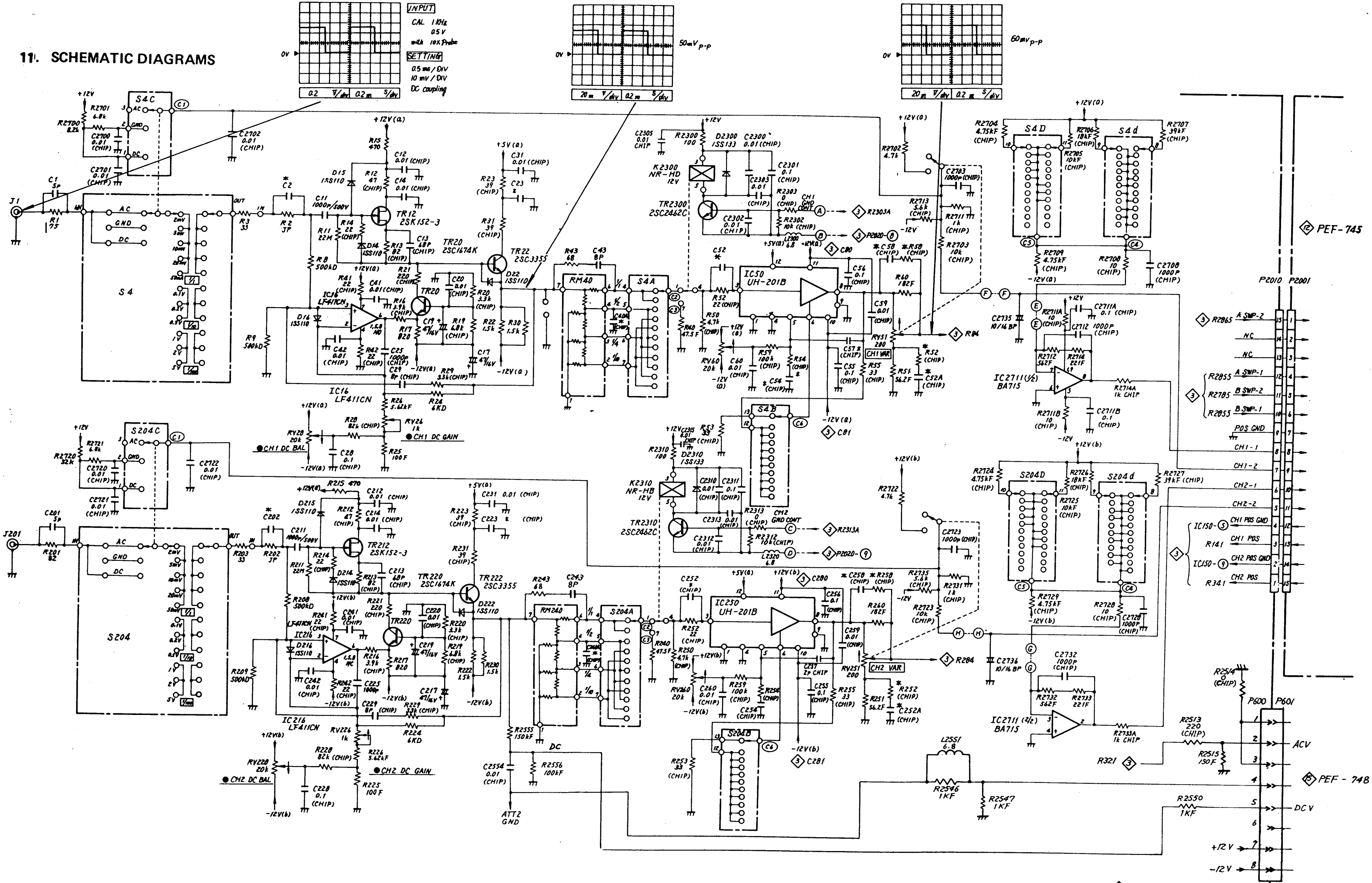
10. BLOCK DIAGRAM





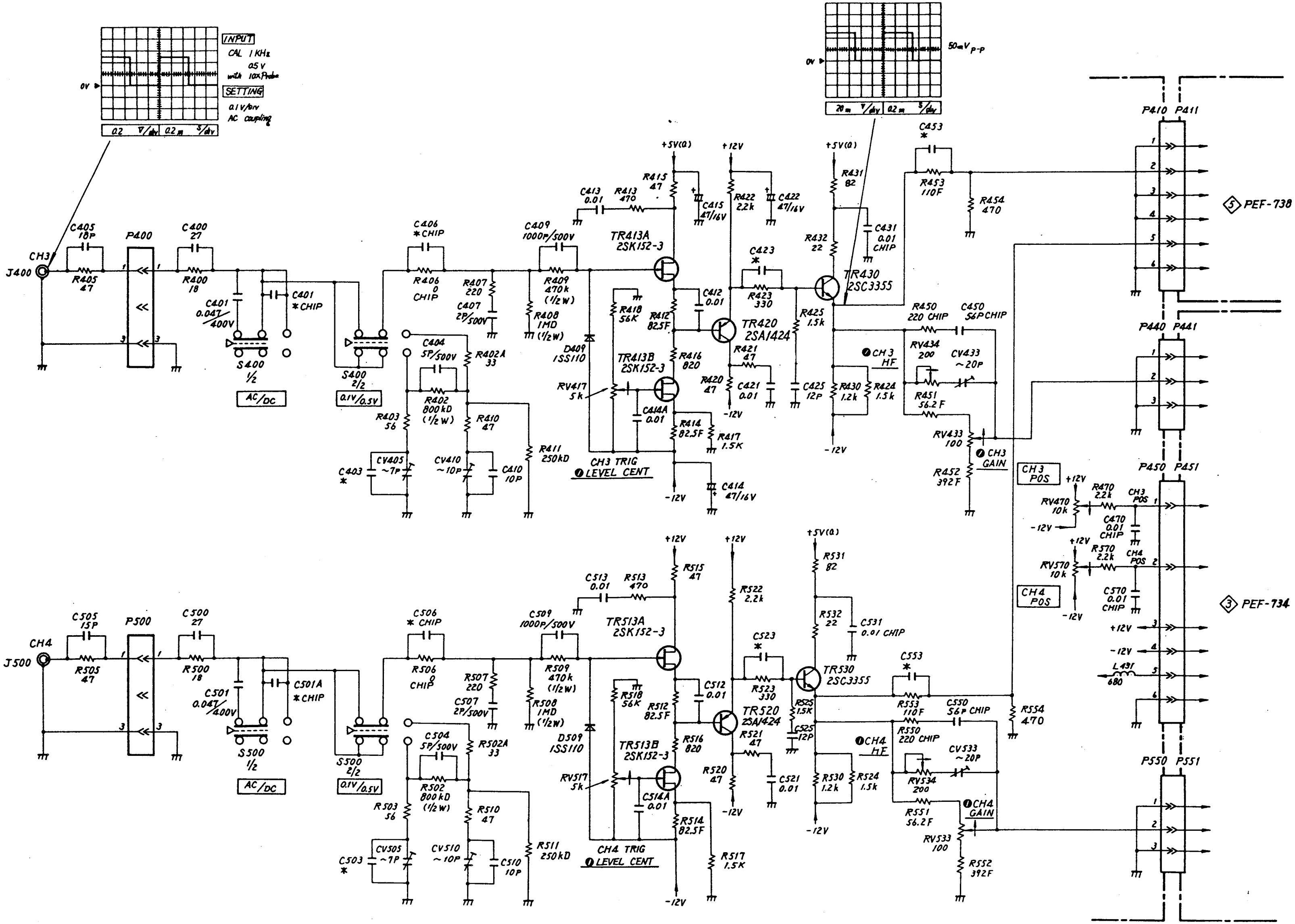
BLOCK DIAGRAM 2

11. SCHEMATIC DIAGRAMS

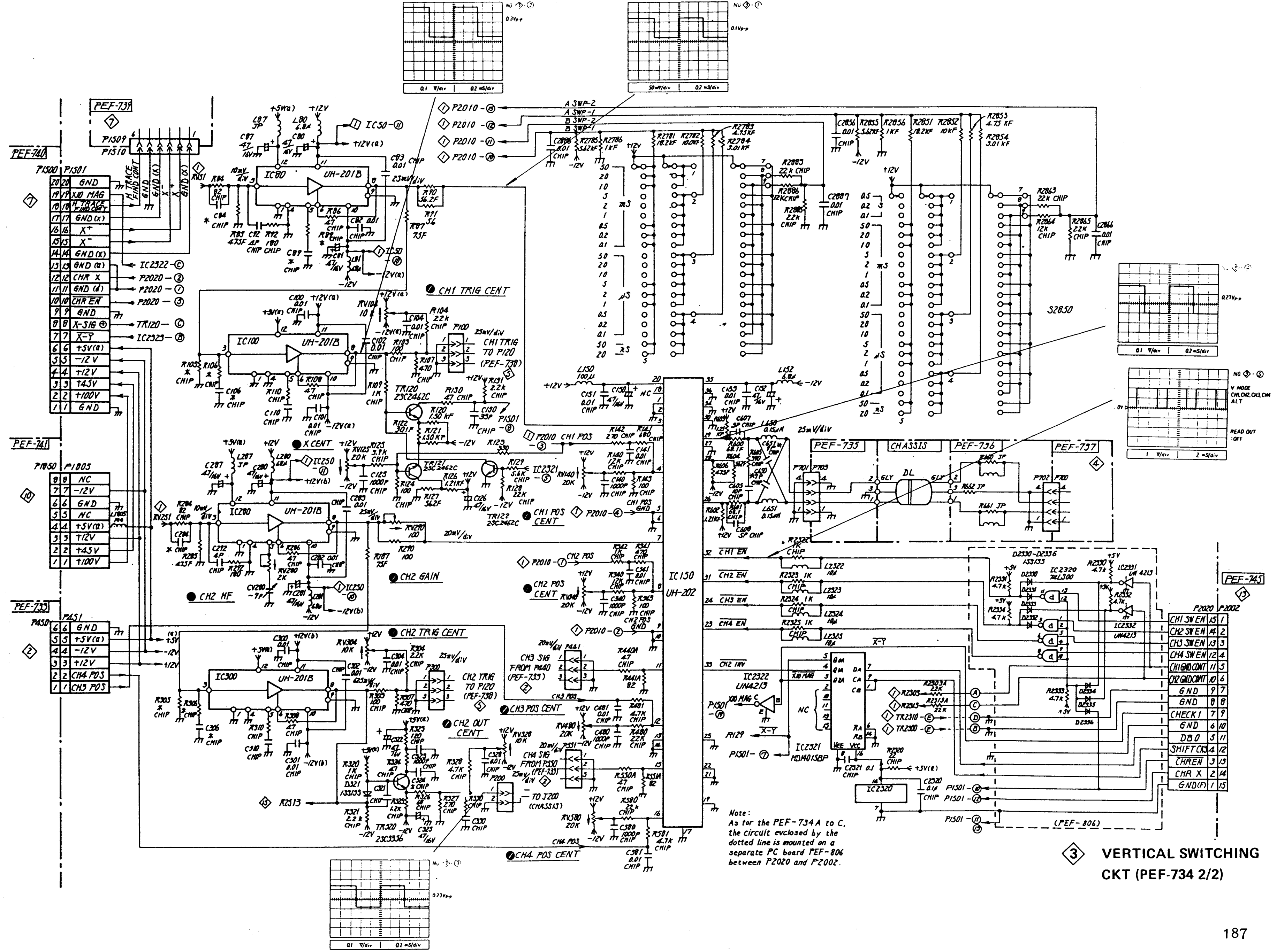


◇1 **CH1, CH2**

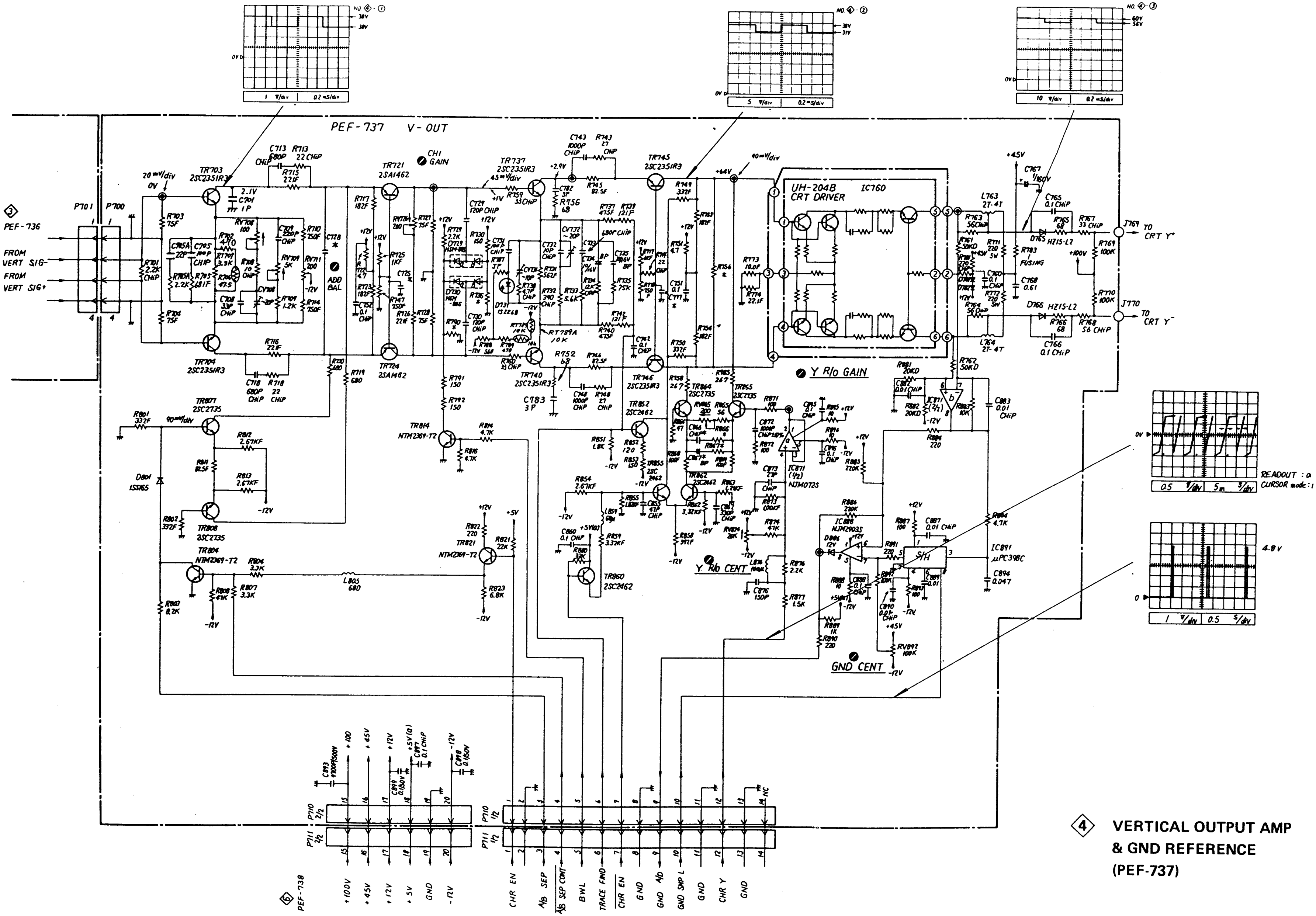
PREAMP (PEF-734 1/2)



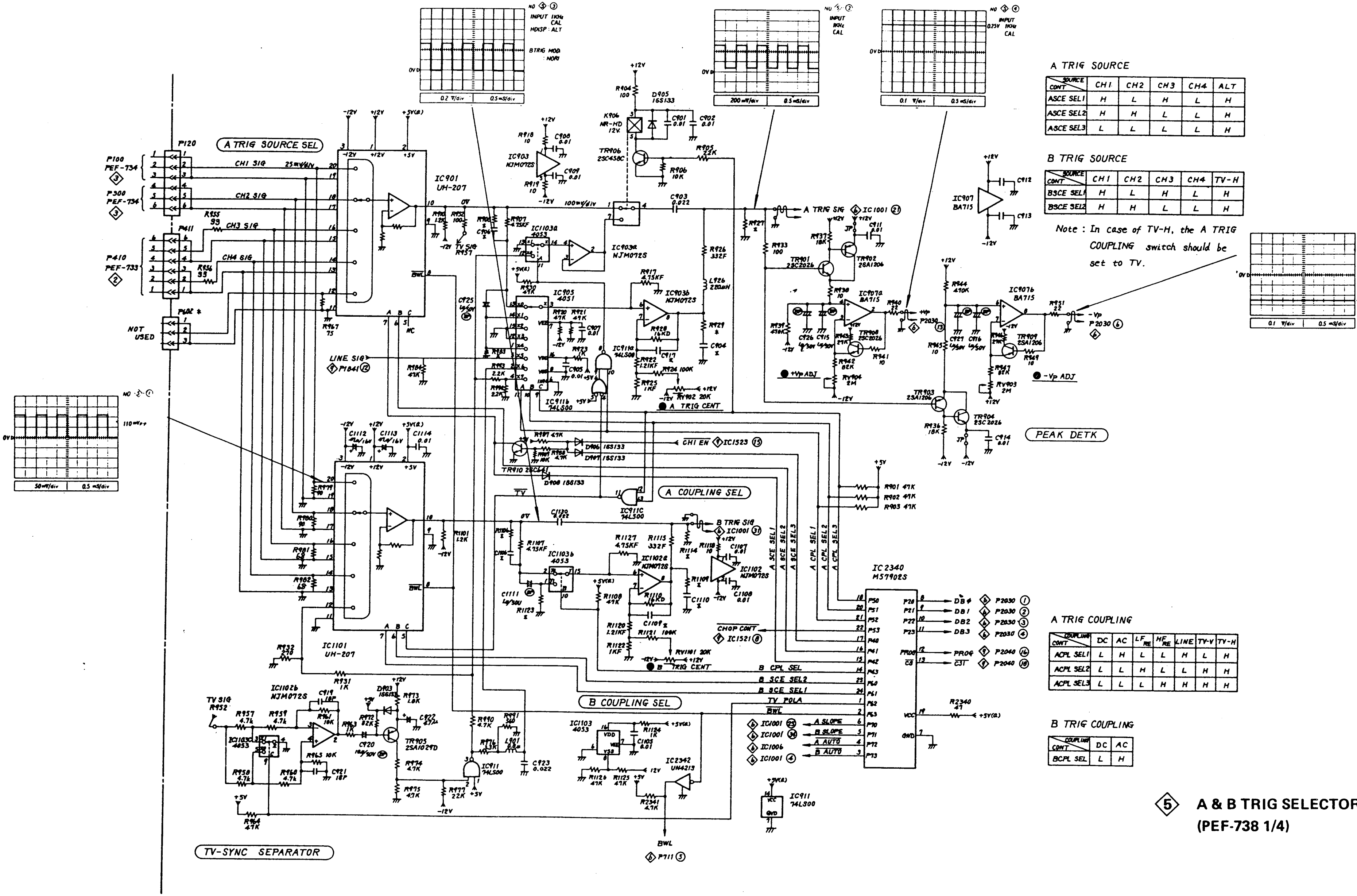
2 CH3, CH4
PREAMP (PEF-733)



VERTICAL SWITCHING CKT (PEF-734 2/2)



4 VERTICAL OUTPUT AMP & GND REFERENCE (PEF-737)



A TRIG SOURCE

CONT \ SOURCE	CH1	CH2	CH3	CH4	ALT
ASCE SEL1	H	L	H	L	H
ASCE SEL2	H	H	L	L	H
ASCE SEL3	L	L	L	L	H

B TRIG SOURCE

CONT \ SOURCE	CH1	CH2	CH3	CH4	TV-H
BSCE SEL1	H	L	H	L	H
BSCE SEL2	H	H	L	L	H

Note : In case of TV-H, the A TRIG COUPLING switch should be set to TV.

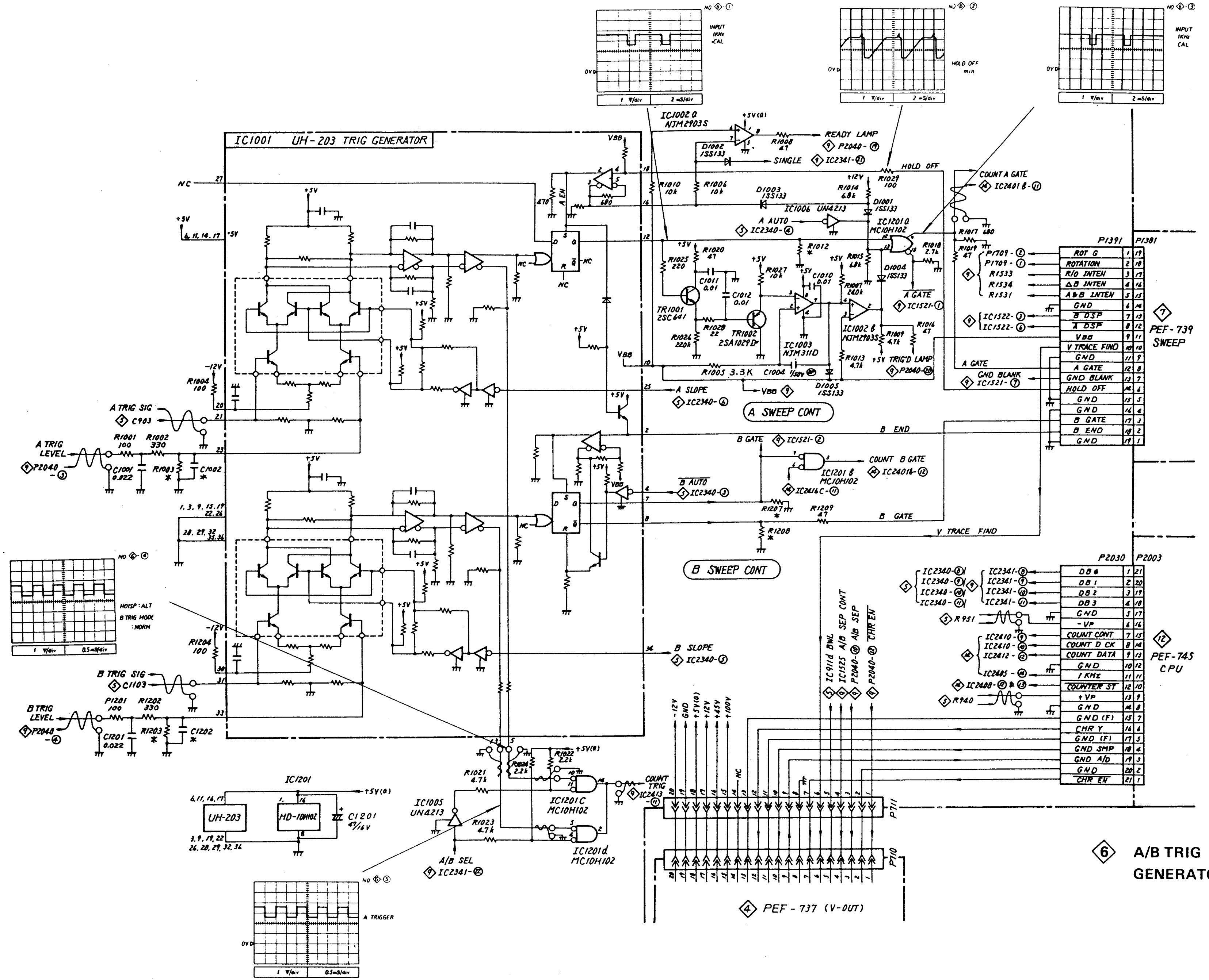
A TRIG COUPLING

CONT \ COUPLING	DC	AC	LF RE	HF RE	LINE	TV-V	TV-H
ACPL SEL1	L	H	L	L	H	L	H
ACPL SEL2	L	L	H	L	L	H	H
ACPL SEL3	L	L	L	H	H	H	H

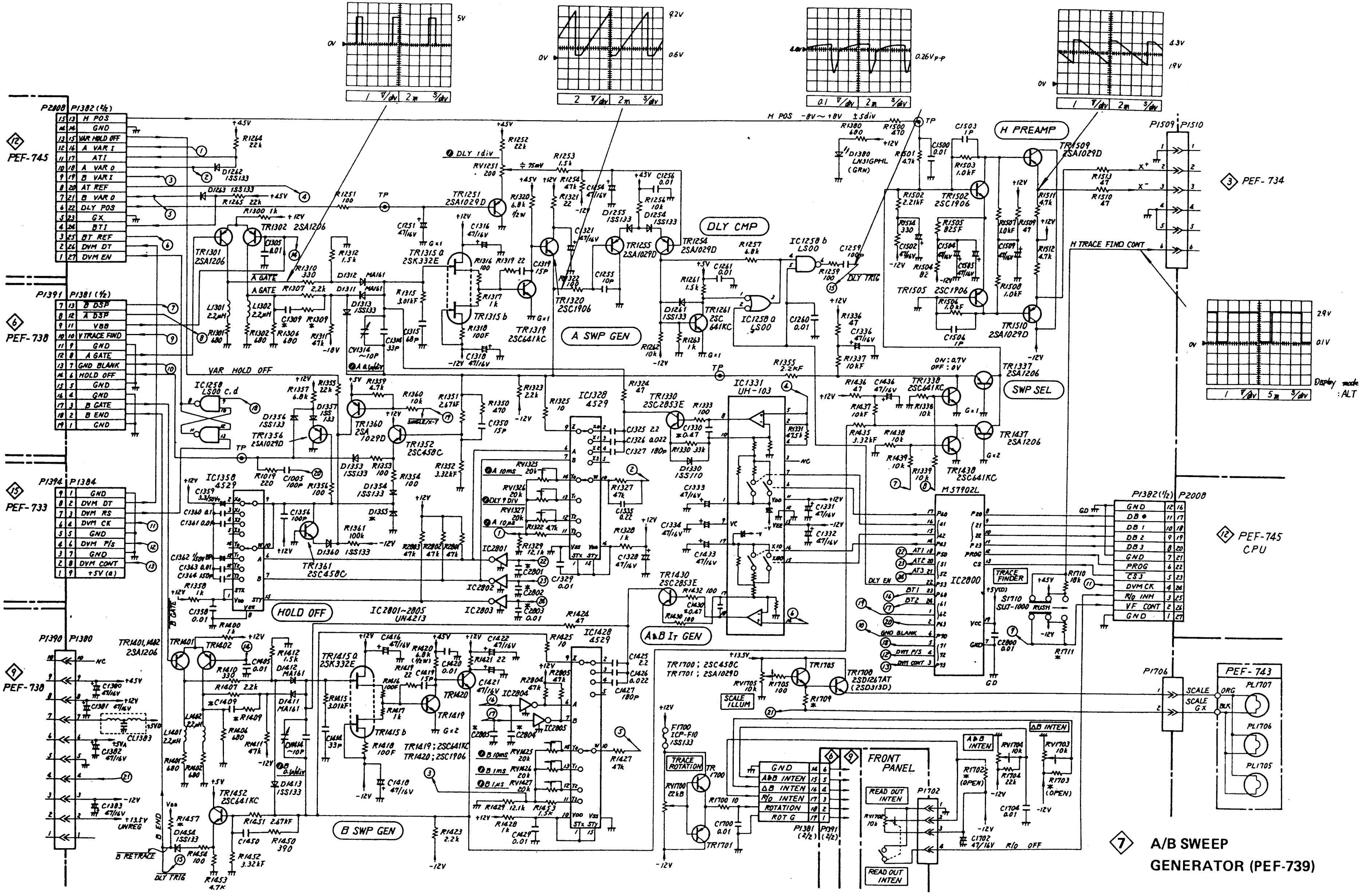
B TRIG COUPLING

CONT \ COUPLING	DC	AC
BCPL SEL	L	H

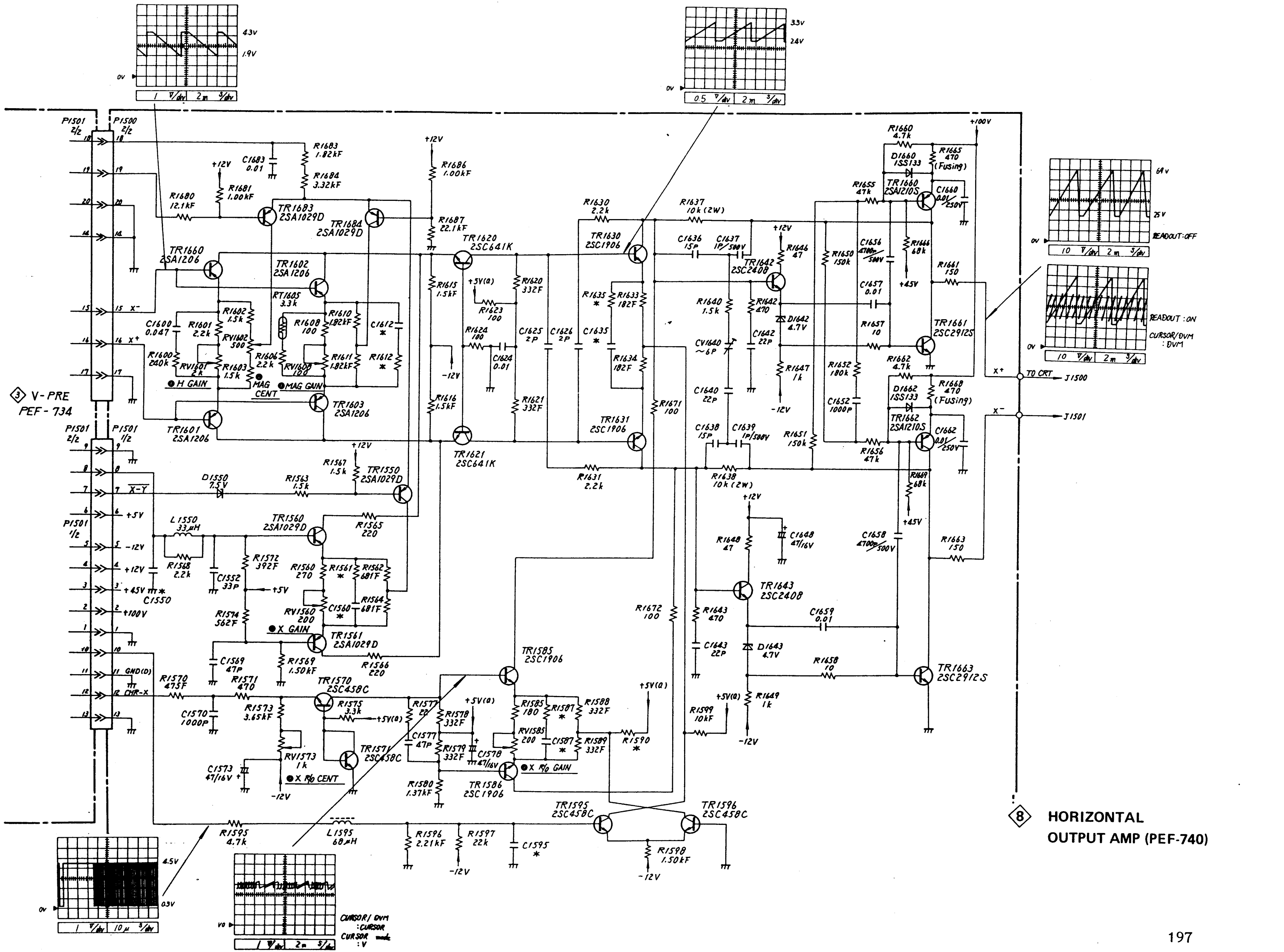
⑤ A & B TRIG SELECTOR (PEF-738 1/4)



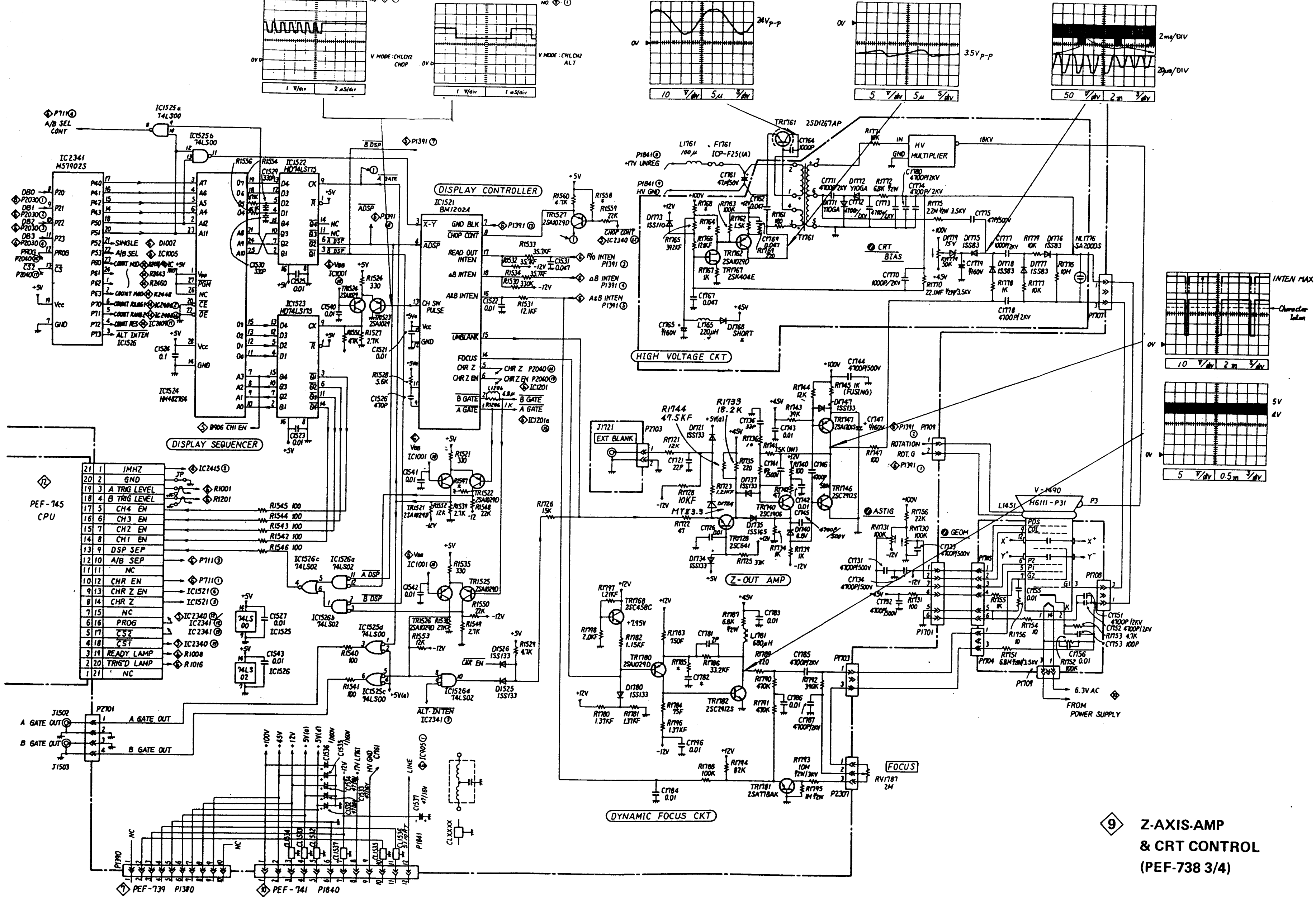
⑥ A/B TRIG GENERATOR (PEF-738 2/4)



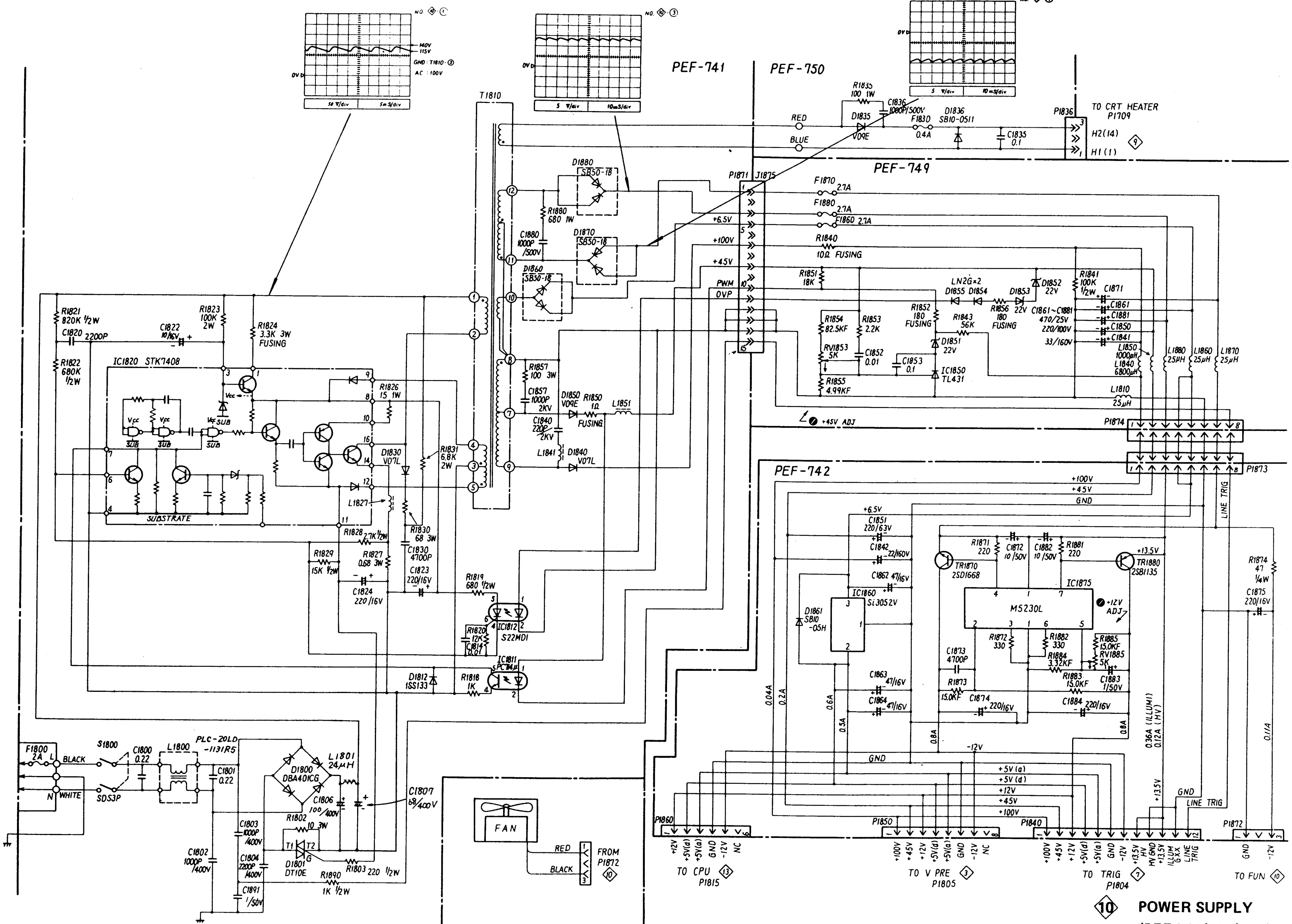
⑦ A/B SWEEP GENERATOR (PEF-739)



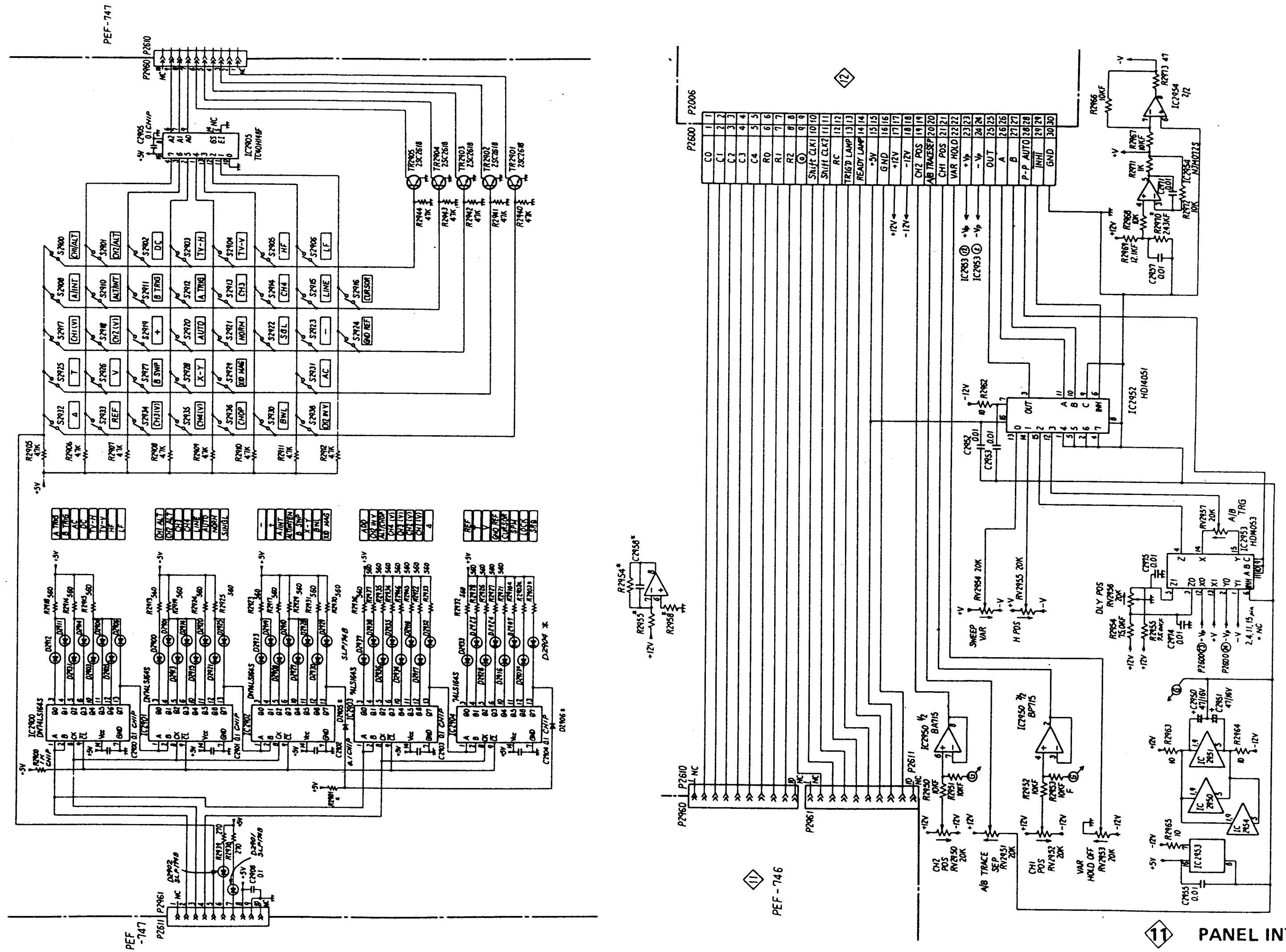
8 HORIZONTAL OUTPUT AMP (PEF-740)



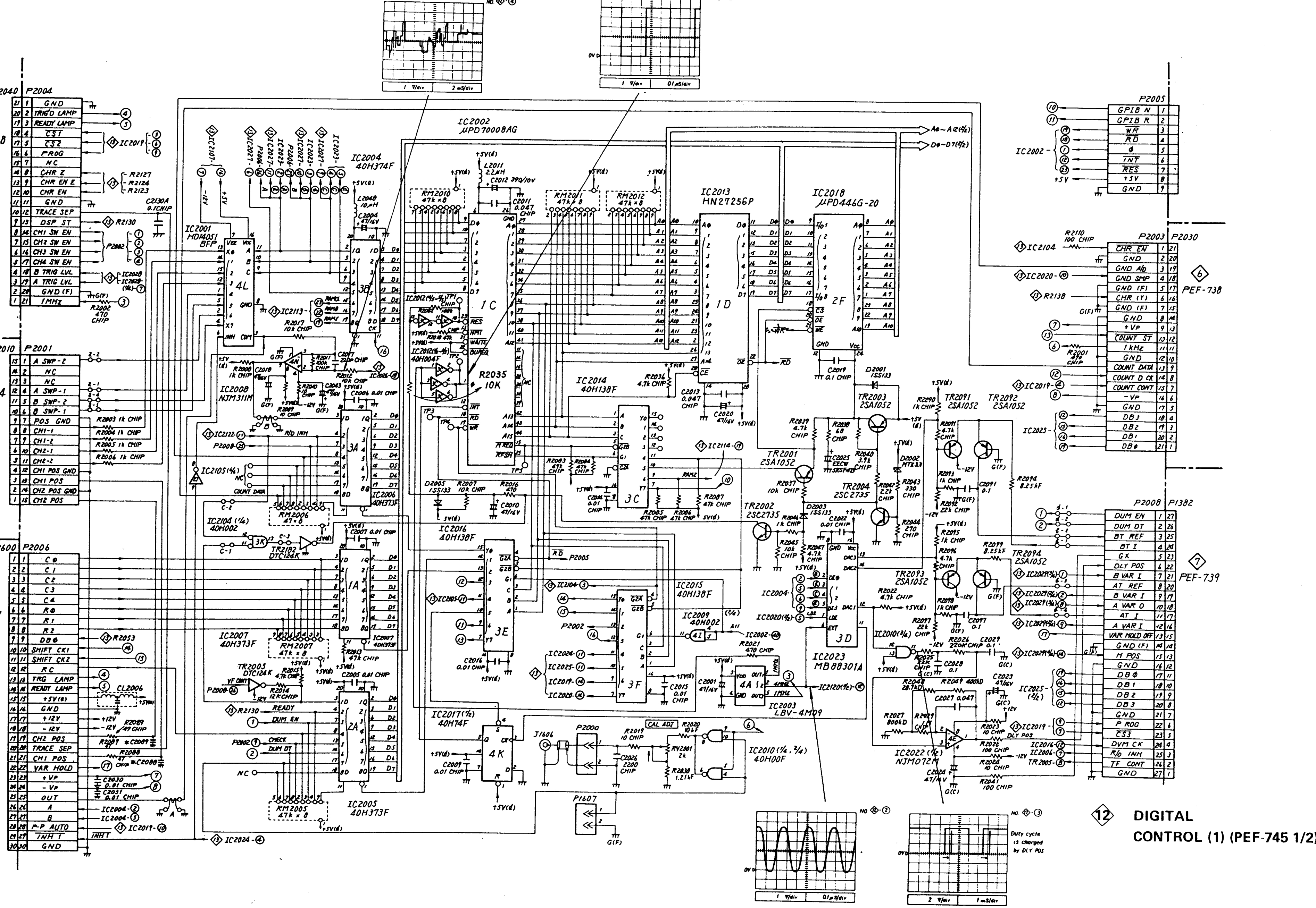
9 Z-AXIS-AMP & CRT CONTROL (PEF-738 3/4)



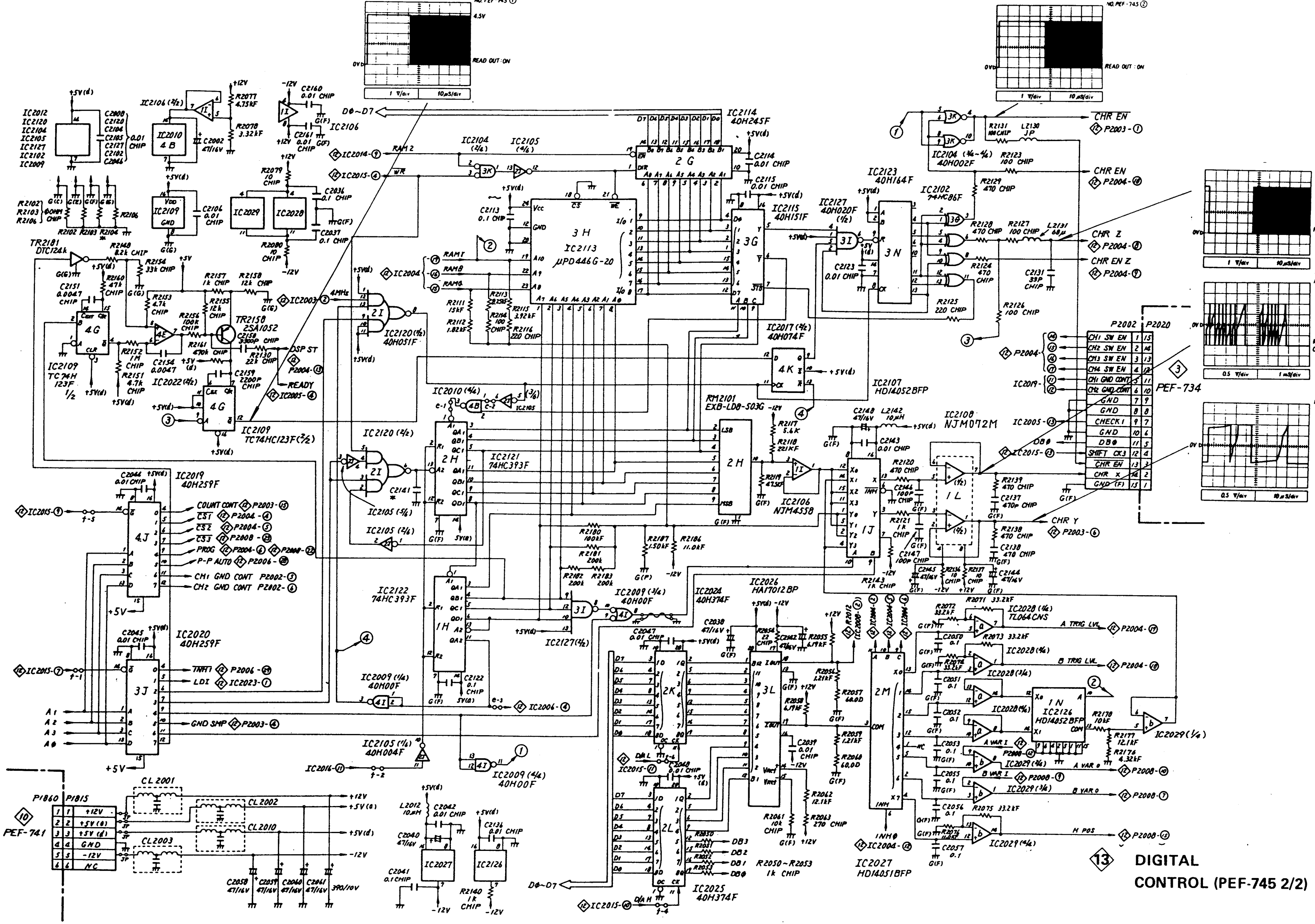
10 POWER SUPPLY
(PEF-741/742/749/750)



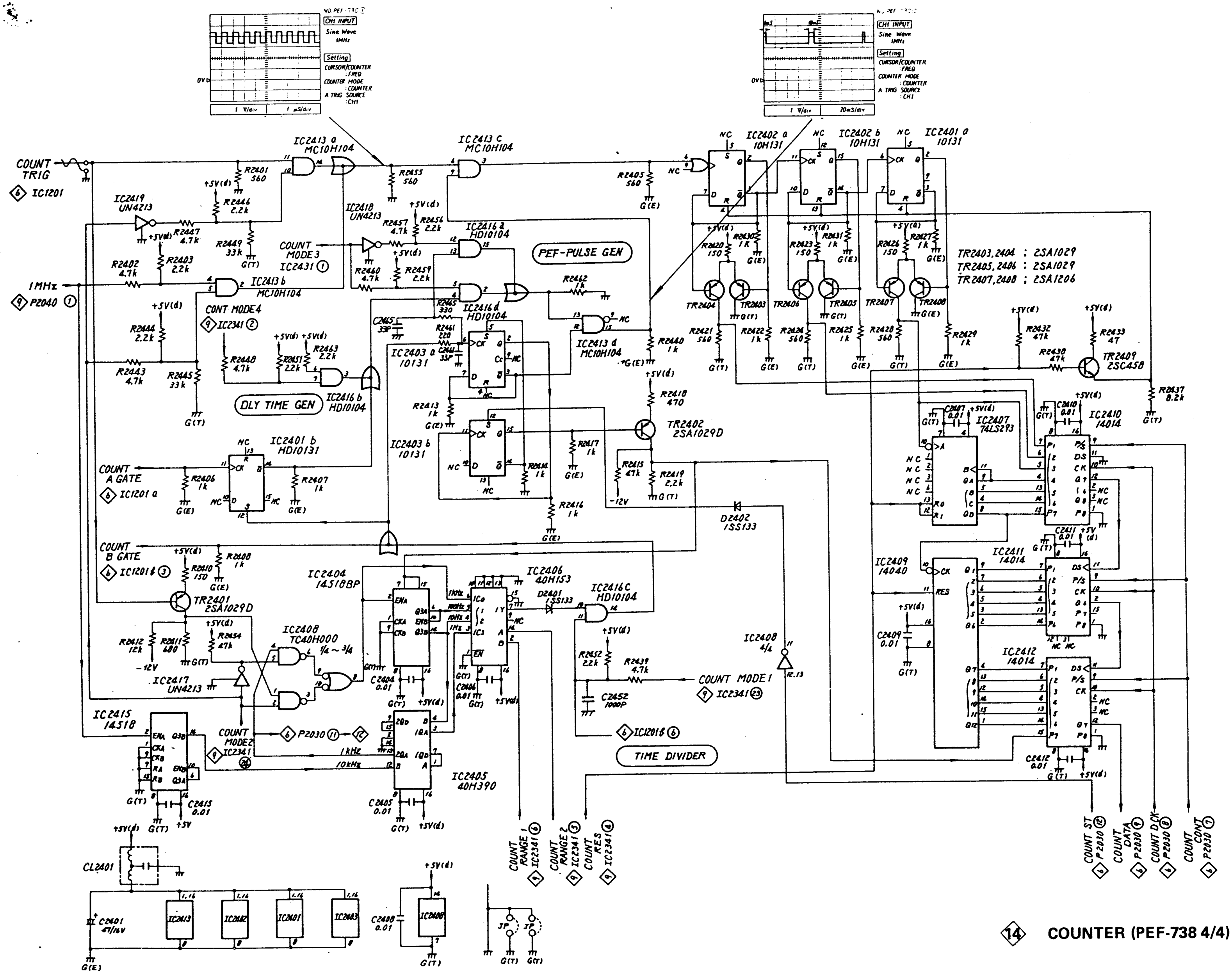
(11) PANEL INTERFACE (PEF-746/747)



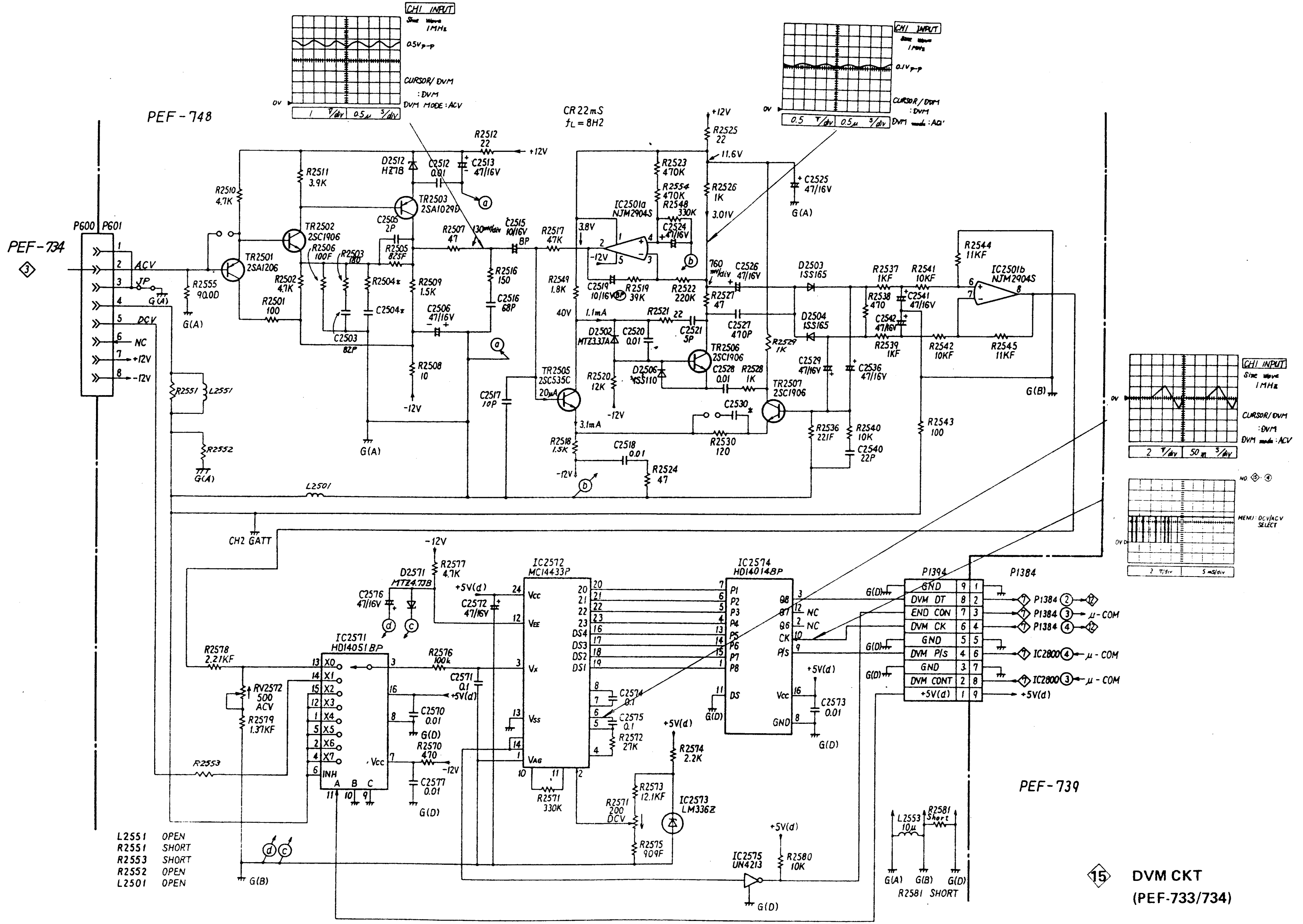
DIGITAL CONTROL (1) (PEF-745 1/2)



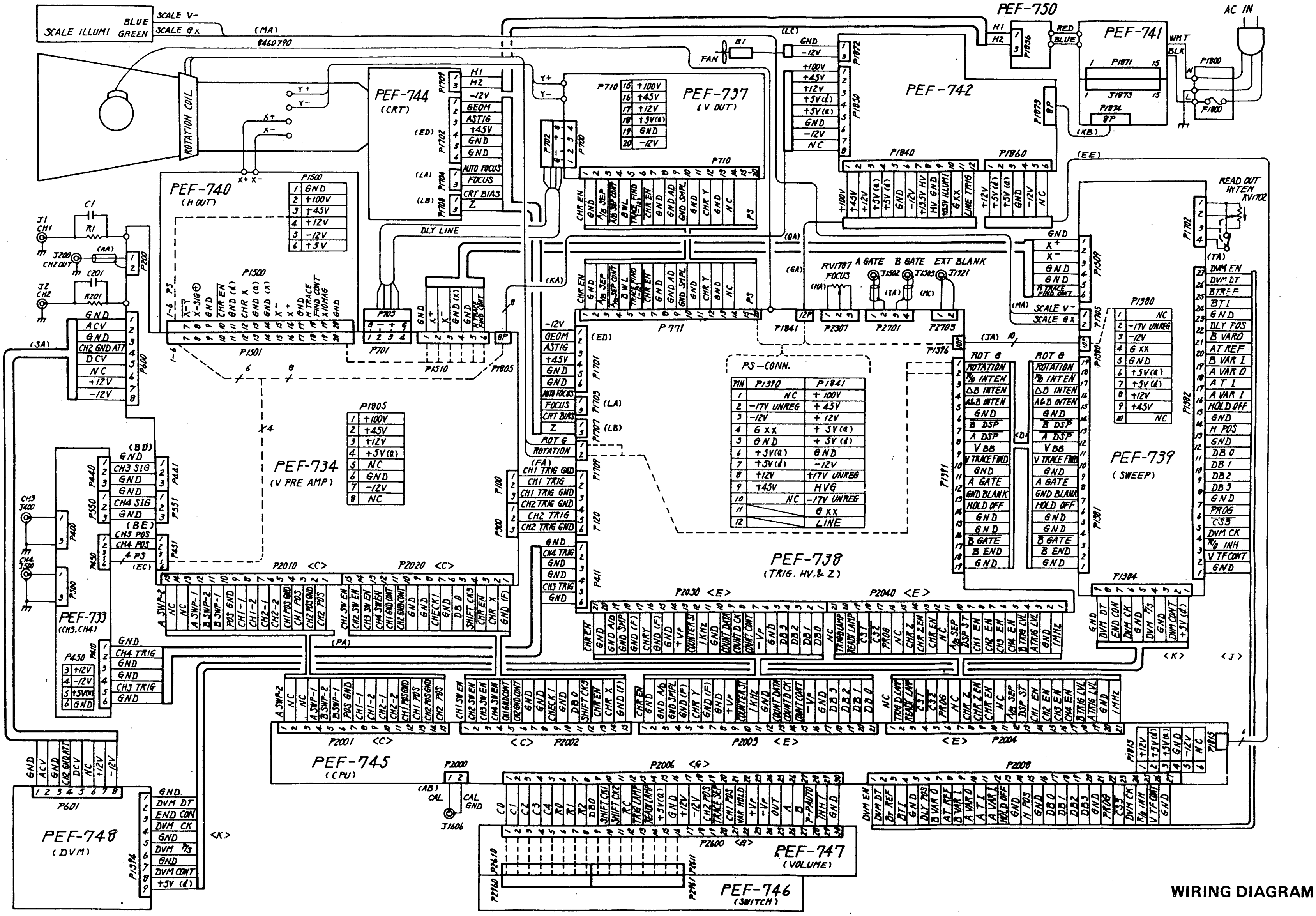
13 DIGITAL CONTROL (PEF-745 2/2)



(14) COUNTER (PEF-738 4/4)



15 DVM CKT (PEF-733/734)

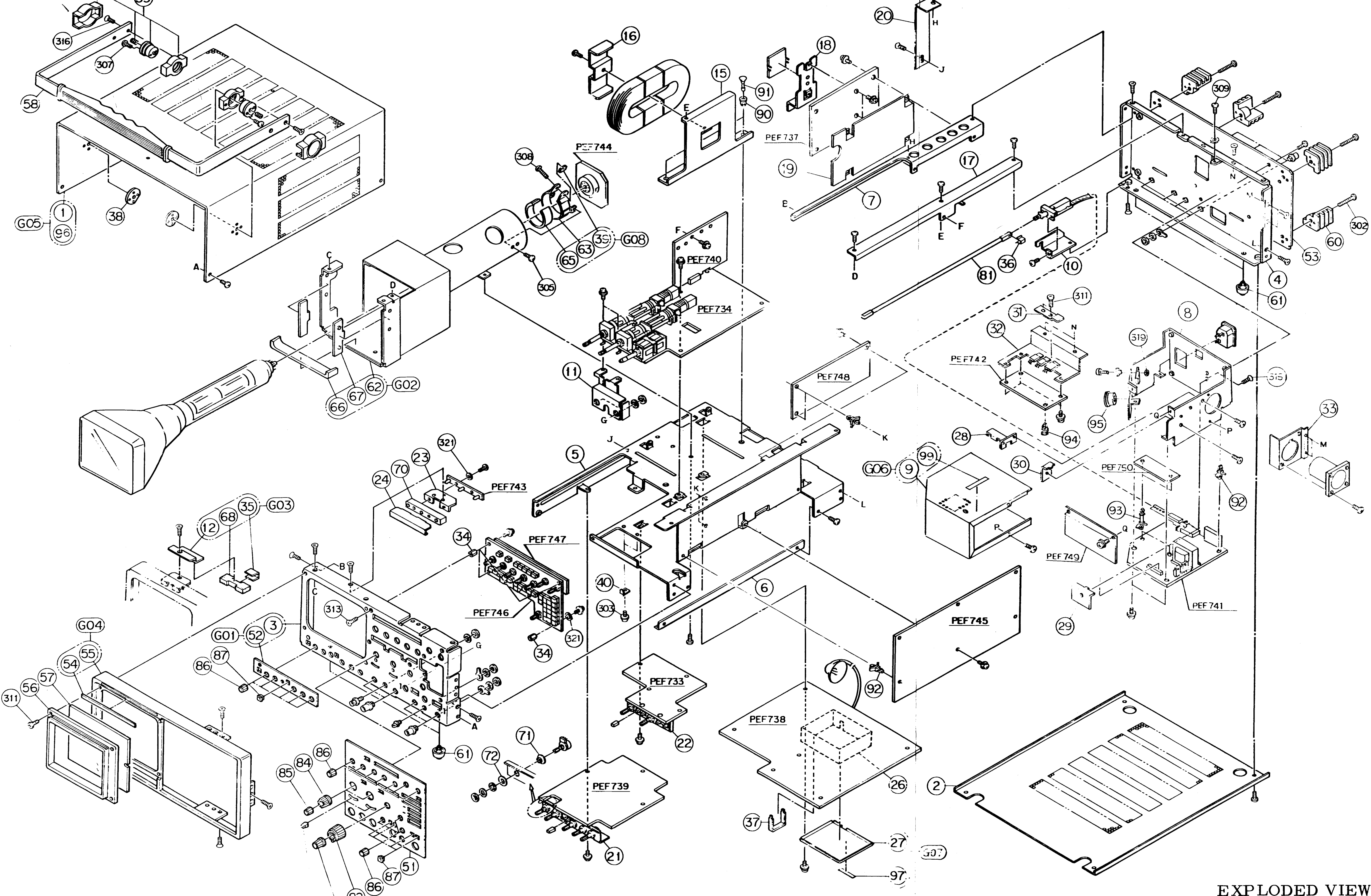


WIRING DIAGRAM

12. MECHANICAL PARTS LIST AND EXPLODED VIEW

Part Code	Symbol	Description	Q'ty	Remarks
8442908B	G05	Cover Assy, Up	1	
3184004B	1	Cover, Up	1	
8432250A	96	Net	1	
3202167A	2	Cover, Bottom	1	
8442904B	G01	Chassis Assy, Front	1	
2115996AA	3	Chassis, Front	1	
8456382A	52	Panel, Front (2)	1	
2115997AA	4	Chassis, Rear	1	
123313AA	5	Chassis, P	1	
8461148A	6	Angle, R	1	
3184007B	7	Angle, L	1	
2119220AA	8	Chassis, T	1	
8469126A	G06	Cover Assy, T	1	
2119221A	9	Cover, T	1	
8467343A	99	Label, VR	1	
8461145A	10	Bracket, PSW	1	
8456379AA	11	Plate, Earth ATT	1	
8442906A	G03	Plate Assy, CRT	1	
8430658A	12	Plate, CRT	1	
8411969A	35	Plate, Earth	1	
8412871A	68	Cushion	1	
3202168A	15	Bracket, DL	1	
8456378A	16	Plate, DL	1	
3202169A	17	Angle, C	1	
8456380A	18	Heat Sink, VO	1	
8466382A	19	Shield, VO (1)	1	
8466383A	20	Shield, VO (2)	1	
8456376A	21	Bracket, SW (1)	1	
8411961A	22	Bracket, SW (4)	1	
8430657A	23	Bracket, Lamp	1	
8450311A	24	Plate, Reflex	1	
3202174A	26	Shield Case, HV	1	
8469127A	G07	Shield Cover Assy, HV	1	
8456377A	27	Shield Cover, HV	1	
4058852A	97	Label, HV	1	
8466385A	28	Bracket, T	1	
8456381A	29	Plate, IC (A)	1	
8456381B	30	Plate, IC (B)	1	
8461147A	31	Plate, T	1	
8466384A	32	Heat Sink, T	1	
8466386A	33	Bracket, Fan	1	
8411970C	34	Support	5	
8406477A	36	Stopper	1	
8441105B	37	Plate, Earth	1	
8398476A	38	Nut, Plate	2	
8469112A	40	Plate, Earth (2)	2	
3202170A	51	Panel, Front (1)	1	
3202171A	53	Panel, Rear	1	
8442907C	G04	Frame Assy	1	
121405B	55	Frame	1	
8437667C	54	Nameplate	1	
288060G	56	Bezel	1	
8416245A	57	Filter	1	
3185462A	58	Handle	1	
8377076A	59	Stopper, Handle	2	
3149317C	60	Foot, Rear	4	
3022087A	61	Foot, Bottom	4	
8469125A				

Part Code	Symbol	Description	Q'ty	Remarks
8469125A	G02	Shield Case Assy, (R)	1	
2116000A	62	Shield Case, CRT	1	
8395443A	66	Rubber (1)	1	
8377074B	67	Rubber	2	
8442911A	G08	Band Assy, CRT	1	
8411966A	63	Band, CRT	1	
8279758A	65	Rubber	1	
8438061A	39	Nut, Plate	1	
8427096C	70	Guide, Lamp	1	
8401613B	71	Insulator (1)	1	
8401614B	72	Insulator (2)	1	
3180083AA	81	Knob, PW	1	
3202172A	82	Knob, SAT	1	
3202173A	83	Knob, SBT	1	
3196622B	84	Knob, ATS	2	
3149324A	85	Knob, S18B	3	
3149324B	86	Knob, S18B-N	14	
8446145A	87 G	Guide, Knob	5	
8456532	88	Knob	2	
XCF0147	90	Nylatch	2	
XCF0328	91	Nylatch	2	
4053815A	92	Support, PCB	7	
8360723J	93	Support	2	
8467342A	94	Spacer	1	
ERR0025	95	Bush	1	
	301	Screw, Sens		M3 x 8
	302	Screw, Sens	4	M4 x 20
	303	Screw, Sens	2	M3 x 6
	305	Screw, Binding	2	M3 x 6
	306	Screw, Binding		M3 x 8
	307	Screw, Binding	5	M3 x 16
	308	Screw, Binding	1	M3 x 20
	309	Screw, Binding	1	M4 x 8
	311	Screw, Black	8	M3 x 10
	313	Screw, Flat	5	M3 x 4
	314	Screw, Flat		M3 x 6
	315	Screw, Flat	2	M3 x 16
	316	Screw, Flat	4	M4 x 10
	319	Nut, Hexagon	1	M3
	321	Washer, Insulator	3	M3
	322	Washer, Toothot Lock	1	M4 (U type)



EXPLODED VIEW